



# STANDARD SPECIFICATIONS FOR PUBLIC INFRASTRUCTURE

THIRD EDITION | JUNE 2020



# **City of Robinson**

## **Standard Specifications**

### **for**

## **Public Infrastructure**

**Third Edition**

**June 2020**



**City of Robinson**  
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#### DIVISION 1 – GENERAL REQUIREMENTS

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## SECTION 01 33 00 - SUBMITTAL PROCEDURES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Proposed product list.
- D. Product data.
- E. Use of electronic CAD files of Project Drawings.
- F. Shop Drawings.
- G. Samples.
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- K. Manufacturer's instructions.
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- N. Contractor review.
- O. Engineer review.

#### 1.2 SUBMITTAL PROCEDURES

- A. Submittals shall be directly from the Contractor. Submittals from others (i.e., suppliers or subcontractors) shall not be accepted.
- B. Transmit each submittal on a City accepted form.
- C. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- D. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- E. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- F. Schedule submittals to expedite Project, and deliver to City at business address. Coordinate submission of related items.
- G. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.
- H. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.
- I. Allow space on submittals for Contractor and City review stamps.
- J. When revised for resubmission, identify changes made since previous submission.

- K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- L. Submittals not requested will not be recognized or processed.
- M. Incomplete Submittals: City will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of City.

### 1.3 CONSTRUCTION PROGRESS SCHEDULES

- A. Contractor shall provide a construction Progress Schedule (when required).

### 1.4 PROPOSED PRODUCT LIST

- A. Within 15 days after date of Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, indicate manufacturer, trade name, model or catalog designation, and reference standards.

### 1.5 PRODUCT DATA

- A. Product Data: Action Submittal: Submit to City for review for assessing conformance with information given and design concept expressed in Contract Documents.
- B. Submit electronic submittals via email as PDF electronic files.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

### 1.6 ELECTRONIC CAD FILES OF PROJECT DRAWINGS

- A. Electronic CAD Files of Project Drawings: May only be used to expedite production of Shop Drawings for the Project. Use for other Projects or purposes is not allowed.
- B. Electronic CAD Files of Project Drawings: Distributed only under the following conditions:
  - 1. Use of files is solely at receiver's risk. Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Contract Documents, notify City of discrepancy and use information in hard-copy Drawings and Specifications.

2. CAD files do not necessarily represent the latest Contract Documents, existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
3. User is responsible for removing information not normally provided on Shop Drawings and removing references to Contract Documents. Shop Drawings submitted with information associated with other trades or with references to Contract Documents will not be reviewed and will be immediately returned.
4. Receiver shall not hold City responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.
5. Receiver shall understand that even though City has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.
6. Receiver shall not hold City responsible for such viruses or their consequences, and shall hold City harmless against costs, losses, or damage caused by presence of computer virus in files or media.

#### 1.7 SHOP DRAWINGS

- A. Shop Drawings: Action Submittal: Submit to City for assessing conformance with information given and design concept expressed in Contract Documents.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional Engineer responsible for designing components shown on Shop Drawings.
  1. Include signed and sealed calculations to support design.
  2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
  3. Make revisions and provide additional information when required by authorities having jurisdiction.
- D. Submit number of reproductions Contractor requires, plus two copies City will retain.
- E. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

#### 1.8 SAMPLES

- A. Samples: Action Submittal: Submit to City for assessing conformance with information given and design concept expressed in Contract Documents.
- B. Samples for Selection as Specified in Product Sections:
  1. Submit to City for aesthetic, color, and finish selection.
  2. Submit Samples of finishes, textures, and patterns for Engineer selection.
- C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

- D. Include identification on each Sample, with full Project information.
- E. Submit number of Samples specified in individual Specification Sections; City will retain one Sample.
- F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.
- G. Samples will not be used for testing purposes unless specifically stated in Specification Section.
- H. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

#### 1.9 DESIGN DATA

- A. Submit for City's knowledge as contract administrator or for Owner.
- B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

#### 1.10 TEST REPORTS

- A. Informational Submittal: Submit reports for City's knowledge as Contract administrator or for Owner.
- B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

#### 1.11 CERTIFICATES

- A. Informational Submittal: When specified in Technical Specifications, submit certification by manufacturer, installation/application Subcontractor, or Contractor to City, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product but must be acceptable to Engineer.

#### 1.12 MANUFACTURER'S INSTRUCTIONS

- A. Informational Submittal: When specified in Technical Specifications, submit manufacturer's installation instructions for City's knowledge as Contract administrator or for Owner.
- B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to City for delivery to Owner in quantities specified for Product Data.



- C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

#### 1.13 MANUFACTURER'S FIELD REPORTS

- A. Informational Submittal: Submit reports for City's knowledge as Contract administrator or for Owner.
- B. Submit report in duplicate within three days of observation to City for information.
- C. Submit reports for information for limited purposes of assessing conformance with information given and design concept expressed in Contract Documents.

#### 1.14 ERECTION DRAWINGS

- A. Informational Submittal: Submit Drawings for City's benefit as Contract administrator or for Owner.
- B. Submit Drawings for information assessing conformance with information given and design concept expressed in Contract Documents.
- C. Data indicating inappropriate or unacceptable Work may be subject to action by City or Owner.

#### 1.15 CONTRACTOR REVIEW

- A. Review for compliance with Contract Documents and approve submittals before transmitting to City.
- B. Contractor: Responsible for:
  - 1. Determination and verification of materials including manufacturer's catalog numbers.
  - 2. Determination and verification of field measurements and field construction criteria.
  - 3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
  - 4. Determination of accuracy and completeness of dimensions and quantities.
  - 5. Confirmation and coordination of dimensions and field conditions at Site.
  - 6. Construction means, techniques, sequences, and procedures.
  - 7. Safety precautions.
  - 8. Coordination and performance of Work of all trades.
- C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.
- D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from City.

#### 1.16 CITY REVIEW

- A. Do not make "mass submittals" to City. "Mass submittals" are defined as six or more submittals or items in one day or 15 or more submittals or items in one week. If "mass

submittals" are received, City's review time stated above will be extended as necessary to perform proper review. City will review "mass submittals" based on priority determined by City.

- B. Informational submittals and other similar data are for City's information, do not require City's responsive action, and will not be reviewed or returned with comment.
- C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.
- D. Submittal approval does not authorize changes to Contract requirements unless accompanied by Change Order, Field Order, or Work Change Directive.

## PART 2 PRODUCTS - Not Used

## PART 3 EXECUTION

### 3.1 Section 31 05 13 – Topsoil

- A. Samples: Submit, in air tight containers, 10 lb sample of each type of fill to testing laboratory.
- B. Materials Source: Submit name of imported materials source.

### 3.2 Section 31 10 10 – Clearing

- A. Product Data: Submit Data for herbicide. Indicate compliance with applicable codes for environmental protection.

### 3.3 Section 31 23 15 – Trench Safety Systems

- A. Trench Safety Plan: Prior to construction the Contractor shall submit five copies of a trench safety system to the City specifically for the construction of trench excavation. The trench safety system shall be in accordance with OSHA standards governing the presence and activities of individuals working in and around trench excavation. The trench safety system must be designed and sealed by a professional engineer registered in the State of Texas with professional experience in Soil Mechanics. The Contractor is responsible for obtaining borings and soil analysis as required for plan design. After receiving the trench safety system plans, the City will forward a copy of the plan to the project inspector, to the Contractor and keep one file copy. The submittal is only for general conformance review with OSHA safety standards and the review does not relieve the Contractor or his design professional of any or all construction means, methods, techniques and procedures. Any property damage, bodily injury or death that arises from use of the trench safety system shall remain the sole responsibility of the Contractor. No trenching in excess of 5 feet below existing grade will be allowed until the plan is submitted. Any changes in the trench safety system after the initiation of construction will not be cause for extension of time or change order and will require the same review process.

#### 3.4 Section 31 23 16 – Excavation

- A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

#### 3.5 Section 31 23 17 – Trenching

- A. Product Data: Submit data for geotextile fabric indicating fabric and construction.
- B. Materials Source: Submit name of imported fill materials suppliers.

#### 3.6 Section 31 23 23 – Fill

- A. Product Data: Submit data for geotextile fabric indicating fabric and construction.
- B. Samples: Submit, in air-tight containers, 50 lb sample of each type of fill to testing laboratory
- C. Materials Source: Submit name of imported fill materials suppliers.

#### 3.7 Section 31 23 24 – Flowable Fill

- A. Materials Source: Submit name of flowable fill materials suppliers (product source).
- B. Manufacturer's Certificate:
  - 1. Certify Product meets or exceeds specified requirements.
- C. Mix Design:
  - 1. Submit flowable fill mix design for each specified strength. Submit separate mix designs when admixtures are require for the following:
    - a. Flowable fill work during hot and cold weather.
    - b. Air entrained flowable fill work.
  - 2. Identify design mix ingredients, proportions, properties, admixtures, and tests.
  - 3. Submit test results to certify flowable fill mix design properties meet or exceed specified requirements.

#### 3.8 Section 31 25 12 – Storm Water Pollution Prevention

- A. Submit one copy of the SWP3 to City for record retention purposes only. City will not review or approve the SWP3.

#### 3.9 Section 31 32 15 – Lime Treatment

- A. Product Data:
  - 1. Submit mix design and materials mix ratio to achieve specified requirements.
  - 2. Submit data for geotextile fabric indicating fabric and construction.
  - 3. Submit data for curing seal.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3.10 Section 32 05 16 – Aggregates for Civil Site Improvements

- A. Materials Source: Submit name of imported materials suppliers.
- B. Manufacturer's Certificate: Certify that aggregates meet or exceed specified requirements.
- C. Samples: Submit, in air-tight containers, 10 lb samples of each type of fill to testing laboratory.

3.11 Section 32 11 23 – Flexible Base

- A. Submit proposed flexible base supplier with supporting laboratory test reports for each type of base as specified in drawings for review and approval prior to beginning of Work. Material shall be from an approved TxDOT source from the local TxDOT District and date shall be no older than 12 months from current date (unless approved by the City).
- B. Materials Source: Submit name of aggregate materials suppliers.
- C. Manufacturer's Certificate: Certify Flexible Base meets or exceeds specified requirements outlined herein.
- D. Samples: Submit, in air-tight containers, 10 lb sample of each type of Flexible Base to testing laboratory.
- E. Product Data:
  - 1. Submit data for geotextile fabric and herbicide.

3.12 Section 32 11 24 – Portland Cement Treated Base (Plant Mixed)

- A. Submit proposed mix design. Design data shall include type and amount of Portland cement; source, gradation, and amount of gravel; and compressive strength verification tests. Compressive strength shall be in the range of 500 to 1200 psi at 7 days.
- B. Materials Source: Submit name of aggregate materials suppliers.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3.13 Section 32 12 16 – Hot Mix Asphaltic Concrete Paving

- A. Product Data:
  - 1. Submit product information for asphalt and aggregate materials.
  - 2. Submit mix design with laboratory test results supporting design.
- B. Submit proposed mix design with laboratory test reports supporting design for each type of mix specified in drawings for review and approval prior to beginning of work. Mix design shall be an approved TxDOT job mix formula from the local TxDOT District and date shall be no older than 12 months from current date (unless approved by City) and shall identify mix ingredients and proportions.

- C. Materials Source: Submit source of all HMAC proposed for use. Certify HMAC complies with specified requirements.

#### 3.14 Section 32 13 00 – Concrete Curb and Gutter

- A. Submit Concrete Mix Design for each class of concrete from a batch plant that is currently certified by the National Ready Mixed Concrete Association. The Mix Designer shall be a licensed professional engineer registered in the State of Texas or a TxDOT approved Mix Designer. Concrete mix design date shall be no older than 12 months from current date (unless approval by City) from the local TxDOT District and shall identify mix ingredients and proportions, including admixtures.
- B. Submit technical information and manufacturer's data for the following: joint filler, dowel bars, admixtures, topping/coating, and curing compounds.

#### 3.15 Section 32 13 13 – Concrete Paving

- A. Product Data:
  - 1. Submit data on concrete materials, reinforcing steel, dowel bars, joint filler, joint sealer, admixtures, and curing compounds.
  - 2. Joint Sealer: Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and conditions requiring special attention.
- B. Submit Concrete Mix Design for each class of concrete from a batch plant that is currently certified by the National Ready Mixed Concrete Association. The Mix Designer shall be a licensed professional engineer registered in the State of Texas or a TxDOT approved Mix Designer. Concrete mix design date shall be no older than 12 months from current date (unless approval by City) from the local TxDOT District and shall identify mix ingredients and proportions, including admixtures.

#### 3.16 Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements

- A. Product Data:
  - 1. Submit data on concrete materials, reinforcing steel, joint filler, joint sealer, admixtures, and curing compounds.
  - 2. Joint Sealer: Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and conditions requiring special attention.
- B. Submit Concrete Mix Design for each class of concrete from a batch plant that is currently certified by the National Ready Mixed Concrete Association. The Mix Designer shall be a licensed professional engineer registered in the State of Texas or a TxDOT approved Mix Designer. Concrete mix design date shall be no older than 12 months from current date (unless approval by City) from the local TxDOT District and shall identify mix ingredients and proportions, including admixtures.

#### 3.17 Section 32 31 13 – Chain Link Fences and Gates

- A. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

- B. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

3.18 Section 32 41 00 – Precast Concrete for Civil Site Improvements

- A. Shop Drawings: Signed and sealed by professional engineer.
  - 1. Indicate layout, unit locations, fabrication details, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials, and sealed by professional engineer in the State of Texas.
- B. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.
- C. Design Data: Signed and sealed by professional engineer in the State of Texas.
  - 1. Submit design data reports indicating calculations for loadings and stresses of fabricated, designed framing and connections.

3.19 Section 32 92 19 – Seeding

- A. Product Data: Submit data for seed mix, fertilizer, mulch, stabilizer and other accessories.

3.20 Section 32 92 23 – Sodding

- A. Product Data: Submit data for sod grass species, fertilizer, mulch, herbicide and other accessories.
- B. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.
- C. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

3.21 Section 33 01 30 – Frames, Grates, Rings, and Covers

- A. Product Data: Submit manhole covers and riser rings construction, features, configuration, dimensions, and manufacturer.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3.22 Section 33 05 14 –Manholes and Structures

- A. Shop Drawings: Indicate structure locations, elevations, piping, conduit, invert configurations, penetration details, and elevations of penetrations.
- B. Product Data: Submit concrete anti-corrosion additives, manhole covers, component construction, features, dimensions, and invert materials.
- C. Submit the following prior to start of testing:
  - 1. Test procedures
  - 2. List of test equipment
  - 3. Testing sequence schedule

4. Provisions for disposal of flushing and test water
5. Certification of test gauge calibration

D. Test Reports: Indicate results of manhole tests

### 3.23 Section 33 05 16 – Utility Structures

A. Shop Drawings:

1. Indicate structure locations, elevations, sections, equipment supports, piping, conduit, and elevations of penetrations.
2. Indicate design, construction and installation details, typical reinforcement and additional reinforcement at openings.

B. Product Data:

1. Submit data for frames and covers, steps (if applicable), component construction, features, configuration, dimensions and hardware (if applicable).
2. Submit data on valve vaults and meter boxes.

C. Design Data:

1. Submit concrete mix design for each different mix.
2. Submit design calculations for custom fabrications signed and sealed by professional engineer.

D. Manufacturer's Certificate: Submit Statement of Compliance, supporting data, from materials suppliers attesting that precast structures provided meet or exceed ASTM Standards and specification requirements.

E. Manufacturer's Certificates: Manufacturer's Installation Instructions: Submit special procedures for precast concrete structures installation.

### 3.24 Section 33 05 19 – Pressure Piping Tied Joint Restraint System

A. Shop Drawings: Indicate restrained joint details and materials being utilized. Submit layout drawings showing piece numbers and locations. Also, indicate restrained joint locations.

B. Product Data: Submit catalog data for restrained joint details and installation instructions.

C. Samples: Submit samples of joint restraint parts.

D. Design Data: Submit design calculations showing determination of restrained lengths and submit joint restraint details. Use joint restraint devices specifically designed for applications described in manufacturer's data.

E. Manufacturer's Installation Instructions: Submit installation instructions.

F. Manufacturer's Certificate: Certify mechanical joints meet or exceed specified requirements.

### 3.25 Section 33 05 22 – Boring and Jacking Pipe

- A. Shop Drawings: Prepare scaled shop Drawings to supplement Contract Drawings, signed and sealed by Professional Engineer.
  - 1. Shop drawings for casing pipe showing sizes and hold down assemblies or casing spacers for carrier pipe.
  - 2. Shop drawings of bulkheads when shown on Drawings.
  - 3. Shop drawings of access manholes shown on Drawings.
  - 4. Design mixes for concrete, grout and flowable fill.
  - 5. Working drawings and written procedures describing in detail proposed bore and jack method and entire operation to be used, for information only, including, but not limited to:
    - a. Working and receiving shafts.
    - b. Dewatering.
    - c. Method of removing soils and installation of casing and carrier pipe.
    - d. Size, capacity, and arrangement of equipment.
    - e. Backstop.
    - f. Shaft base material.
    - g. Type of cutter head.
    - h. Method of monitoring and controlling line and grade.
    - i. Detection of surface movement.
    - j. Procedure for installing pipe supports, anchors, or placement of grout between carrier pipe and casing pipe.
    - k. Bulkhead details and proposed positive method of anchoring carrier pipe to prevent floatation.
    - l. Catalog data for casing spacers when used for temporary support during construction.
    - m. Procedure for monitoring line and grade.
  - 6. If modifications to methods are required during construction, submit working drawings delineating modifications, including reasons for them.
- B. Submit history of previous work completed of equivalent nature and scope. Include qualification and work experience. Furnish list of references upon request.
- C. Installation Plan: Submit description of proposed construction plan, dewatering plan, and plan to establish and maintain vertical and horizontal alignment.
- D. Submit Texas Department of Transportation's permit for installations along and/or under public right-of-way and lands.
- E. Submit emergency response procedures to handle situations when conduit is compromised and jeopardizes integrity of installation or safety.
- F. Submit written report results of visual check prior to installation of carrier pipe of entire length of casing, to verify there are no voids nor defective joints.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.



### 3.26 Section 33 11 13 – Public Water Utility Distribution Piping and Appurtenances

- A. Piping
  - 1. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.
  - 2. Shop Drawings: Indicate piping layout, including piping specialties.
  - 3. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- B. Valves
  - 1. Shop Drawing:
    - a. Installation Plan: Submit description of proposed installation.
  - 2. Design Data: Submit manufacturer's latest published literature including illustrations, installation instructions, maintenance instructions and parts lists.
  - 3. Manufacturer's Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessories provided meet or exceed AWWA Standards and specification requirements.
- C. Fire Hydrant Assemblies
  - 1. Shop Drawing:
    - a. Installation Plan: Submit description of proposed installation.
  - 2. Design Data: Submit manufacturer's latest published literature include illustrations, installation instructions, maintenance instructions and parts lists.
  - 3. Manufacturer's Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that hydrants and accessories provided meet or exceed AWWA Standards and specification requirements.
- D. Design Data: Submit latest published literature including illustrations, installation instructions, maintenance instructions and parts list.
- E. Testing
  - 1. Product Data: Submit procedures, proposed chemicals, and treatment levels.
  - 2. Test Reports: Indicate results comparative to specified requirements.
  - 3. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

### 3.27 Section 33 12 00 – Water Utility Distribution Equipment

- A. Backflow Preventer
  - 1. Product Data:
    - a. Submit data on backflow preventer assemblies.
    - b. Piping: Submit data on pipe materials, fittings, and accessories.
    - c. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
    - d. Supports: Submit manufacturers catalog information including load capacity.
    - e. Manufacturer's Instructions: Submit installation instructions for backflow preventer assemblies, valves, and accessories.
  - 2. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

3.28 Section 33 12 13 – Water Service Connections

- A. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.
- B. Shop Drawings: Provide shop drawings for precast concrete vaults to include detail drawings showing the vault and accessories.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3.29 Section 33 31 13 – Public Sanitary Utility Sewerage Piping

- A. Product Data: Submit catalog cuts and other pertinent data indicating proposed materials, accessories, details, and construction information.
- B. Submit reports indicating field tests made and results obtained.
- C. Manufacturer's Installation Instructions:
  - 1. Indicate special procedures required to install Products specified.
  - 2. Submit detailed description of procedures for connecting new sewer to existing sewer line and directional drilling pipe jacking installation.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Submit the following prior to start of testing:
  - 1. Test procedures
  - 2. List of test equipment
  - 3. Testing sequence schedule
  - 4. Provisions for disposal of flushing and test water
  - 5. Certification of test gauge calibration
  - 6. Deflection mandrel drawings and calculations
- F. Test Reports: Indicate results of piping tests

3.30 Section 33 41 13 – Public Storm Utility Drainage Piping and Culverts

- A. Product Data: Submit data indicating pipe, pipe accessories, and gasket material.
- B. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

END OF SECTION

## SECTION 01 40 00 - QUALITY REQUIREMENTS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Quality control.
- B. Tolerances.
- C. References.
- D. Labeling.
- E. Testing and inspection services.
- F. Manufacturers' field services.

#### 1.2 QUALITY CONTROL

- A. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from City before proceeding.
- D. Products, materials, and equipment may be subject to inspection by City at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of Contract Documents.
- E. Supervise performance of Work in such manner and by such means to ensure that Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.
- F. Perform work in accordance with Texas Department of Transportation's Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges (latest Edition). Maintain one copy on site.

#### 1.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' recommended tolerances and tolerance requirements in reference standards. When such tolerances conflict with Contract Documents, request clarification from City before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

#### 1.4 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current as of date for receiving Bids except where specific date is established by code.
- C. Obtain copies of standards and maintain on Site when required by product Specification Sections.
- D. When requirements of indicated reference standards conflict with Contract Documents, request clarification from City before proceeding.
- E. Neither contractual relationships, duties, or responsibilities of parties in Contract nor those of City shall be altered from Contract Documents by mention or inference in reference documents.

#### 1.5 LABELING

- A. Attach label from agency approved by authorities having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:
  - 1. Model number.
  - 2. Serial number.
  - 3. Performance characteristics.
- C. Manufacturer's Nameplates, Trademarks, Logos, and Other Identifying Marks on Products: Not allowed on surfaces exposed to view in public areas, interior or exterior.

#### 1.6 TESTING AND INSPECTION SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency or laboratory acceptable to City to perform specified testing.
  - 1. Before starting Work, submit testing laboratory name, address, and telephone number, and names of full-time Professional Engineer and responsible officer.
  - 2. Submit copy of report of laboratory facilities' inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.
- B. Independent testing firm will perform tests, inspections, and other services specified in individual Specification Sections and as required by City. In the event of a conflict in the Contract Documents concerning sampling and testing frequency, the more stringent standard shall be enforced, unless otherwise approved by the City.
  - 1. Laboratory: Authorized to operate in State of Texas.
  - 2. Laboratory Staff: Maintain full-time Professional Engineer on staff to review services.

3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.
- C. Testing, inspections, and source quality control may occur on or off Project Site.
- D. Cooperate with independent testing firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
  1. Notify City and independent testing firm 48 hours before expected time for operations requiring services.
  2. Make arrangements with independent testing firm and pay for additional Samples and tests required for Contractor's use.
- E. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work according to requirements of Contract Documents.
- F. Retesting or re-inspection required because of nonconformance with specified or indicated requirements shall be performed by same independent testing firm on instructions from City. Payment for retesting or re-inspection will be paid by Contractor.
- G. Independent Testing Firm Responsibilities:
  1. Test Samples of mixes submitted by Contractor.
  2. Provide qualified personnel at Site. Cooperate with City and Contractor in performance of services.
  3. Perform indicated sampling and testing of products according to specified standards.
  4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  5. Promptly notify City and Contractor of observed irregularities or nonconformance of Work or products.
  6. Perform additional tests required by City.
  7. Attend preconstruction meetings and progress meetings.
- H. Material Testing Reports: After each test, Independent Testing Firm shall promptly submit two copies of testing reports to City, Contractor, and other entities as directed, indicating observations and results of tests and compliance or noncompliance with Contract Documents. At a minimum, include the following information in testing reports:
  1. Date issued.
  2. Project title and number.
  3. Name of inspector/testing technician.
  4. Date and time of sampling or inspection.
  5. Identification of product and Specification Section.
  6. Location in Project.
  7. Type of inspection or test.
  8. Date of test.
  9. Results of tests.
  10. Compliance or noncompliance with Contract Documents.
  11. Special observations, if any.

Submit final report indicating correction of Work previously reported as noncompliant. Log all test results in an electronic spreadsheet for each test procedure and provide updated versions to City at agreed upon time interval.

- I. Limits on Independent Testing Firm:
  1. Independent Testing Firm may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  2. Independent Testing Firm may not approve or accept any portion of the Work.
  3. Independent Testing Firm may not assume duties of Contractor.
  4. Independent Testing Firm has no authority to stop the Work.

#### 1.7 MANUFACTURER'S FIELD SERVICES

- A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, testing, adjusting, and balancing of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to City 30 days in advance of required observations. Observer is subject to approval of City.
- C. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.
- D. Refer to Section 01 33 00 - Submittal Procedures, "Manufacturer's Field Reports" Article.

#### PART 2 PRODUCTS - Not Used

#### PART 3 EXECUTION

##### 3.1 Material Lab Testing and Contractor Inspection Requirements

| Material Lab Testing and Contractor Inspection Requirements |               |                      |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------|---------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction Work                                           | Specification | Testing Requirements | Frequency of Testing                                                                                                                                                                                                                                                                                                                                                                                                      |
| Trench Safety Systems                                       | 31 23 15      |                      | Contractor shall make daily inspection of trench safety systems to ensure that the systems meet OSHA requirements. Daily inspection shall be made by competent personnel. If evidence of possible cave-ins or slides is apparent, all work in the trench shall cease until necessary precautions have been taken to safeguard personnel entering trench. Contractor shall maintain permanent record of daily inspections. |

| Material Lab Testing and Contractor Inspection Requirements |               |                                                                                                                                                                                                                           |                                                                                                                                                                                                                             |
|-------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction Work                                           | Specification | Testing Requirements                                                                                                                                                                                                      | Frequency of Testing                                                                                                                                                                                                        |
| Excavation                                                  | 31 23 16      | Compaction Density Tests; ASTM D698, Method D, Standard Proctor                                                                                                                                                           | 1 per 5,000 SF                                                                                                                                                                                                              |
|                                                             |               | Compaction Moisture Tests: ASTM D3017                                                                                                                                                                                     | 1 per 5,000 SF                                                                                                                                                                                                              |
|                                                             |               | Visual inspection                                                                                                                                                                                                         | Request visual inspection of bearing surfaces by City before installing subsequent work. The City shall be notified not less than three working days prior to the visual inspection.                                        |
| Trenching                                                   | 31 23 17      | Laboratory Material Tests: ASTM D698                                                                                                                                                                                      | 1 ea. per 300 linear feet per lift along the trench line for areas subjected to or influenced by vehicular traffic. 1 ea. per 1000 linear feet per lift along the trench line for areas not subjected to vehicular traffic. |
|                                                             |               | In-Place Compaction Density Tests: ASTM D2922 (Re. Paragraph 3.7)                                                                                                                                                         |                                                                                                                                                                                                                             |
| Fill                                                        | 31 23 23      | Compaction Moisture Tests: ASTM D3017                                                                                                                                                                                     | Same as "In-Place Compaction Density Test"                                                                                                                                                                                  |
|                                                             |               | Perform laboratory material tests in accordance with ASTM D698                                                                                                                                                            | Obtain for each material encountered within project limits.                                                                                                                                                                 |
|                                                             |               | Perform in place compaction tests in accordance with the following:<br>1. Density Tests: ASTM D1556, ASTM D2167, ASTM D2922, or TEX-115-E as appropriate for the material being tested.<br>2. Moisture Tests: ASTM D3017. |                                                                                                                                                                                                                             |
|                                                             |               | Select Fill: Subsoil Type S1 (Select Fill or Select Borrow)                                                                                                                                                               | 1 per soil Type (Sample size: 50 lbs.)<br>- Gradation<br>- P.I.<br>- Moisture-Density Relationship                                                                                                                          |

| Material Lab Testing and Contractor Inspection Requirements |               |                                                                                          |                                                                                                       |
|-------------------------------------------------------------|---------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Construction Work                                           | Specification | Testing Requirements                                                                     | Frequency of Testing                                                                                  |
|                                                             |               | Compaction (Field Density Tests)                                                         | 1 per 5,000 SF per lift (min. of 3 per lift)                                                          |
|                                                             |               | Subsoil for Fill and Backfill:<br>Subsoil Type S2 (Borrow);<br>Subsoil Type S3 (On-Site) | 1 per soil Type (Sample size: 50 lbs.)<br>- Gradation<br>- P.I.<br>- Moisture-Density Relationship    |
|                                                             |               | Compaction (Field Density Tests)                                                         | 1 per 5,000 SF per lift (min. of 3 per lift)                                                          |
|                                                             |               | Structural Fill: Coarse Aggregate Type A1 (Flexible Base)                                | 1 ea. per type per 1,000 CY. (Sample size: 50 lbs.)<br>- Sieve<br>- P.I.<br>- Moisture-Density        |
|                                                             |               | Compaction (Field Density Tests)                                                         | 1 ea. per 2,500 SF per lift (min. of 3 per lift)                                                      |
|                                                             |               | Structural Fill: Coarse Aggregate Type A2 (Crushed Stone)                                | 1 ea. per type per 1,000 CY. (Sample size: 50 lbs.)<br>- Gradation/sieve                              |
|                                                             |               | Compaction (Field Density Tests)                                                         | 1 ea. per 2,500 SF per lift (min. of 3 per lift)                                                      |
|                                                             |               | Structural Fill: Coarse Aggregate Type A3; Coarse Aggregate Type A4                      | 1 ea. per type per 1,000 CY. (Sample size: 50 lbs.)<br>- Sieve<br>- P.I.<br>- Moisture-Density        |
|                                                             |               | Compaction (Field Density Tests)                                                         | 1 ea. per 2,500 SF per lift (min. of 3 per lift)                                                      |
| Flowable Fill                                               | 31 23 24      | Perform inspection and testing in accordance with ASTM C94                               | Take samples for tests for every 150 cu yd of flowable fill, or fraction thereof, installed each day. |



| Material Lab Testing and Contractor Inspection Requirements |               |                                                                                                                                                                 |                                                                                                                        |
|-------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Construction Work                                           | Specification | Testing Requirements                                                                                                                                            | Frequency of Testing                                                                                                   |
|                                                             |               | Compressive Strength Test<br>Cylinders in accordance with<br>ASTM D4832                                                                                         | Sample, prepare, and test four (4)<br>cylinders. Test one specimen at 3<br>days, one at 7 days, and two at 28<br>days. |
|                                                             |               | Temperature                                                                                                                                                     | Measure temperature at point of<br>deliver when samples are<br>prepared.                                               |
|                                                             |               | Perform in-place density tests<br>using nuclear test device, in<br>accordance with ASTM<br>C1040.                                                               | Perform tests at locations as<br>directed by City.                                                                     |
| Lime Treatment                                              | 31 32 15      | Actual amount of lime required<br>shall be confirmed by<br>laboratory tests (ASTM C977)<br>prior to construction by an<br>acceptable materials testing<br>firm. |                                                                                                                        |
|                                                             |               | Thickness of Lime<br>Stabilization                                                                                                                              | 1 ea. per 500 SY (per lift)                                                                                            |
|                                                             |               | Density (Tex-115-E)                                                                                                                                             | 1 ea. per 500 SY (per lift)                                                                                            |
|                                                             |               | Atterburg Limit Test:<br>confirming P.I. ≤ 15                                                                                                                   | 1 ea. per 500 SY (per lift)                                                                                            |
|                                                             |               | Gradation                                                                                                                                                       | 1 ea. per 500 SY (per lift)                                                                                            |
|                                                             |               | pH (After Treatment):<br>per Tex 121-E, Part III<br>(pH > 12.4)                                                                                                 | 1 ea. per 500 SY (per lift)                                                                                            |
| Flexible Base                                               | 32 11 23      | Compaction testing:<br>Tex-113-E.<br><br>Field density testing:<br>Tex-115-E.                                                                                   | 1 ea. per 1,000 SY of each course<br>(layer) of compacted base<br>material.                                            |
| Portland Cement<br>Treated Base                             | 32 11 24      | Unconfined Compression<br>Testing (@ 7 days) 500 to<br>1200 psi                                                                                                 | 1 sample per day (3 specimens per<br>sample)                                                                           |

| Material Lab Testing and Contractor Inspection Requirements |                                              |                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction Work                                           | Specification                                | Testing Requirements                                                                                                                                                | Frequency of Testing                                                                                                                                                                                                                                                                                                                                                                 |
|                                                             |                                              | Compaction Testing:<br>ASTM D698                                                                                                                                    | 1 ea. per 1,000 SY                                                                                                                                                                                                                                                                                                                                                                   |
|                                                             |                                              | Compaction Moisture Tests:<br>ASTM D3017                                                                                                                            | 1 ea. per 1,000 SY                                                                                                                                                                                                                                                                                                                                                                   |
| Hot Mix Asphaltic<br>Concrete Paving                        | 32 12 16                                     | Asphalt Paving Mix<br>Temperature                                                                                                                                   | Measure temperature at time of<br>placement.                                                                                                                                                                                                                                                                                                                                         |
|                                                             |                                              | Asphalt Paving Thickness:<br>ASTM D3549                                                                                                                             | 1 core sample (test) from every<br>1,000 SY compacted paving                                                                                                                                                                                                                                                                                                                         |
|                                                             |                                              | Laboratory Density:<br>Tex-207-F Part I                                                                                                                             | 1 core sample (test) from every<br>1,000 SY or 1 per day (minimum)<br>of compacted paving.                                                                                                                                                                                                                                                                                           |
|                                                             |                                              | In-Place Density:<br>Tex-207-F Part III or IV                                                                                                                       | 1 per day (minimum) of<br>compacted paving.                                                                                                                                                                                                                                                                                                                                          |
| Concrete                                                    | 32 30 00<br>32 13 00<br>32 13 13<br>32 41 00 | Strength Test Samples:<br>1. Sampling Procedures:<br>ASTM C172<br>2. Cylinder Molding and<br>Curing Procedures: ASTM<br>C31, Cylinder Specimens,<br>standard cured. | Make 1 set (four cylinders) for<br>each class of concrete placed.<br><br>Class A and C – Make one set per<br>every 25 CY or less<br><br>Class P – Make one set for every<br>2,500 SF or less                                                                                                                                                                                         |
|                                                             |                                              | Field Testing:<br>1. Slump Test Method: ASTM<br>C143<br>2. Air Content Test Method:<br>ASTM C173<br>3. Temperature Test Method:<br>ASTM C1064                       | Measure Slump, Air Content and<br>Temperature for each set of<br>cylinders.                                                                                                                                                                                                                                                                                                          |
|                                                             |                                              | Cylinder Compressive Strength<br>Testing:<br>ASTM C39                                                                                                               | Test one cylinder at 7 days. Test<br>two cylinders at 28 days. Retain<br>one cylinder for 28 days for testing<br>when requested by City.<br><br>Average compressive strength of 3<br>consecutive test results equal or<br>exceed specified compressive<br>strength, and no individual<br>strength test result falls below<br>specified compressive strength by<br>more than 500 psi. |

| Material Lab Testing and Contractor Inspection Requirements |               |                                                                                                                                                    |                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction Work                                           | Specification | Testing Requirements                                                                                                                               | Frequency of Testing                                                                                                                                                                                                                                                                         |
| Manholes and Structures                                     | 33 05 14      | Vacuum Test:<br>ASTM C1244                                                                                                                         | 1 per manhole.                                                                                                                                                                                                                                                                               |
| Utility Structures                                          | 33 05 16      | Concrete Testing:<br>Per Section 32 41 00<br><br>Backfill Compaction Testing:<br>ASTM D698                                                         | 2 per structure                                                                                                                                                                                                                                                                              |
| Boring and Jacking Pipe                                     | 33 05 22      | Compaction Testing:<br>Per Section 31 23 23                                                                                                        | 2 for each lift.                                                                                                                                                                                                                                                                             |
| Public Water Distribution Piping and Appurtenances          | 33 11 13      | Pressure and leakage tests:<br>Per Section 33 11 13, Re. Paragraph 3.13 – Field Quality Control<br><br>Compaction Testing:<br>Per Section 31 23 17 | Bedding, embedment, and backfill shall be tested and verified at 1 ea. per 300 linear feet per lift along the trench line for areas subjected to or influenced by vehicular traffic. 1 ea. per 1000 linear feet per lift along the trench line for areas not subjected to vehicular traffic. |
| Water Utility Distribution Equipment                        | 33 12 00      | Pressure and leakage tests:<br>Per Section 33 11 13, Re. Paragraph 3.13 – Field Quality Control                                                    | Perform pressure test on each backflow assembly.                                                                                                                                                                                                                                             |
| Water Service Connections                                   | 33 12 13      | Pressure and leakage tests:<br>Per Section 33 11 13, Re. Paragraph 3.13 – Field Quality Control<br><br>Compaction Testing:<br>Per Section 31 23 17 | Perform pressure test with all service connections.<br><br>Compaction testing once per service.                                                                                                                                                                                              |
| Public Sanitary Utility Sewerage Piping                     | 33 31 13      | Sewer Pipe Testing:<br>Re. Paragraph 3.13 – Sewer Pipe Testing                                                                                     |                                                                                                                                                                                                                                                                                              |

| Material Lab Testing and Contractor Inspection Requirements |               |                                             |                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------|---------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction Work                                           | Specification | Testing Requirements                        | Frequency of Testing                                                                                                                                                                                                                                                                         |
|                                                             |               | Compaction Testing:<br>Per Section 31 23 17 | Bedding, embedment, and backfill shall be tested and verified at 1 ea. per 300 linear feet per lift along the trench line for areas subjected to or influenced by vehicular traffic. 1 ea. per 1000 linear feet per lift along the trench line for areas not subjected to vehicular traffic. |
| Public Storm Utility<br>Drainage Piping and<br>Culverts     | 33 41 13      | Compaction Testing:<br>Per Section 31 23 17 | Bedding, embedment, and backfill shall be tested and verified at 1 ea. per 300 linear feet per lift along the trench line for areas subjected to or influenced by vehicular traffic. 1 ea. per 1000 linear feet per lift along the trench line for areas not subjected to vehicular traffic. |

END OF SECTION

## SECTION 01 60 00 - PRODUCT REQUIREMENTS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.
- E. Equipment electrical characteristics and components.
- F. Product substitutions and procedures.

#### 1.2 PRODUCTS

- A. Specified products define standard of quality, type, function, dimension, appearance, and performance required.
- B. Furnish products of qualified manufacturers that are suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm that manufacturer's production capacity can provide sufficient product, on time, to meet Project requirements.
- C. Domestic Products: Except where specified otherwise, domestic products are required and interpreted to mean products mined, manufactured, fabricated, or produced in United States or its territories.
- D. Do not use materials and equipment removed from existing premises except as specifically permitted by Contract Documents.
- E. Furnish interchangeable components from same manufacturer for components being replaced.

#### 1.3 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products according to manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

#### 1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products according to manufacturer's instructions.
- B. Store products with seals and labels intact and legible.
- C. Store sensitive products in weathertight, climate-controlled enclosures in an environment suitable to product.

- D. For exterior storage of fabricated products, place products on sloped supports aboveground.
- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- G. Provide equipment and personnel to store products; use methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

#### 1.5 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Products complying with specified reference standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and complying with Specifications; no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit Request for Substitution for any manufacturer not named.

### PART 2 PRODUCTS

#### 2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Include lugs for terminal box.
- B. Cord and Plug: Furnish minimum 6-foot long cord and plug including grounding connector for connection to electric wiring system. Cord of longer length may be specified in individual Specification Sections.

### PART 3 EXECUTION - Not Used

END OF SECTION

## SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Field engineering.
- B. Closeout procedures.
- C. Project record documents.
- D. Spare Parts and Maintenance Products.
- E. Product Warranties and Product Bonds.
- F. Maintenance Service.
- G. Examination.
- H. Execution.
- I. Cutting and patching.
- J. Protecting installed construction.
- K. Final cleaning.

#### 1.2 FIELD ENGINEERING

- A. Owner will locate and Contractor shall protect survey control and reference points. Promptly notify City of discrepancies discovered.
- B. Control datum for survey is established by Owner-provided survey indicated on Drawings.
- C. Contractor shall verify setbacks and easements; confirm Drawing dimensions and elevations.
- D. Protect survey control points prior to starting Site Work; preserve permanent reference points during construction.
- E. Promptly report to City loss or destruction of reference point or relocation required because of changes in grades or other reasons.
- F. Contractor shall retain Engineer to replace dislocated survey control points based on original survey control.

#### 1.3 CLOSEOUT PROCEDURES

- A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire Work or for portions of Work:
  - 1. Submit maintenance manuals, Project record documents, digital images of construction photographs, and other similar final record data in compliance with this Section.
  - 2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.
  - 3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.

4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.
5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
6. Make final change-over of locks and transmit keys directly to Owner. Advise Owner's personnel of change-over in security provisions.
7. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
8. Perform final cleaning according to this Section.

B. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.

1. When Contractor considers Work to be complete, submit written certification that:
  - a. Contract Documents have been reviewed.
  - b. Work has been examined for compliance with Contract Documents.
  - c. Work has been completed according to Contract Documents.
  - d. Work is completed and ready for final inspection.
2. Submittals: Submit following:
  - a. Final punch list indicating all items have been completed or corrected.
  - b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
  - c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
  - d. Accounting statement for final changes to Contract Sum.
  - e. Contractor's affidavit of payment of debts and claims on Contractor's Affidavit of Payment of Debts and Claims.
  - f. Contractor affidavit of release of liens on Contractor's Affidavit of Release of Liens.
  - g. Consent of surety to final payment on Consent of Surety to Final Payment Form.
3. Perform final cleaning for Contractor-soiled areas according to this Section.

#### 1.4 PROJECT RECORD DOCUMENTS

- A. Maintain on Site one set of the following record documents; record actual revisions to the Work:
1. Drawings.
  2. Specifications.
  3. Addenda.
  4. Change Orders and other modifications to the Contract.
  5. Reviewed Shop Drawings, product data, and Samples.
  6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including the following:



1. Manufacturer's name and product model and number.
2. Product substitutions or alternates used.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:

1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, and change orders.
2. Include locations of concealed elements of the Work.
3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
5. Identify and locate existing buried or concealed items encountered during Project.
6. Measured depths of foundations in relation to vertical datum.
7. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
8. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
9. Field changes of dimension and detail.
10. Details not on original Drawings.

G. Submit marked-up paper copy documents to City with claim for final Application for Payment.

H. Submit PDF electronic files of marked-up documents to City with claim for final Application for Payment.

## 1.5 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.
- B. Deliver to Project Site and place in location as directed by Owner; obtain receipt prior to final payment.

## 1.6 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by responsible Subcontractors, suppliers, and manufacturers within ten days after completion of applicable item of Work.
- B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.
- E. Include table of contents and assemble in three D side ring binder with durable plastic cover.

- F. Submit prior to final Application for Payment.
- G. Time of Submittals:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
  - 2. Make other submittals within ten days after date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

## 1.7 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components indicated in Specification Sections for one year from date of Substantial Completion.
- B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
- D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

## PART 2 PRODUCTS - Not Used

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual Specification Sections.
- D. Verify that utility services are available with correct characteristics and in correct locations.

### 3.2 EXECUTION

- A. Comply with manufacturer's installation instructions, performing each step in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.

- B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from City before proceeding.
- C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
  - 1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.

### 3.3 CUTTING AND PATCHING

- A. Employ skilled and experienced installers to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements affecting:
  - 1. Structural integrity of element.
  - 2. Integrity of weather-exposed or moisture-resistant elements.
  - 3. Efficiency, maintenance, or safety of element.
  - 4. Visual qualities of sight-exposed elements.
  - 5. Work of Owner or separate contractor.
- C. Execute cutting, fitting, and patching including excavation and fill to complete Work and to:
  - 1. Fit the several parts together, to integrate with other Work.
  - 2. Uncover Work to install or correct ill-timed Work.
  - 3. Remove and replace defective and nonconforming Work.
  - 4. Remove samples of installed Work for testing.
  - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Execute Work by methods to avoid damage to other Work and to provide proper surfaces to receive patching and finishing.
- E. Cut concrete materials using concrete saw or core drill.
- F. Restore Work with new products according to requirements of Contract Documents.
- G. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.
- H. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.
- I. Identify hazardous substances or conditions exposed during the Work to City for decision or remedy.

### 3.4 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual Specification Sections.

- B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.
- C. Prohibit traffic from landscaped areas.

### 3.5 FINAL CLEANING

- A. Execute final cleaning prior to final Project assessment.
- B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; and clean soft surfaces.
- C. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.
- D. Clean debris from sanitary sewers and drainage systems.
- E. Clean Site; sweep paved areas, rake clean landscaped surfaces.
- F. Remove waste and surplus materials, rubbish, and construction facilities from Site.

END OF SECTION

## DIVISION 31 - EARTHWORK

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END OF SECTION

## SECTION 31 05 13 - TOPSOIL

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Description: This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, and placing and spreading the topsoil on prepared areas in accordance with this specification at the locations shown on the Drawings or as directed by the City.
- B. Section Includes:
  - 1. Topsoil materials.

#### 1.2 UNIT PRICES - MEASUREMENT AND PAYMENT

- A. Basis of Measurement: The measurement of Topsoil, when included in the Contract as a separate pay item, will be measured by one of the following: Method A - the cubic yard in its final position based upon the average end areas taken from pre-construction cross sections, plan grades, or surface comparisons; or, Method B – by the square yard at the depth specified. The plan quantities for Topsoil will be used as the measurement and payment for this item.
- B. Basis of Payment: All work performed as required herein and measured as provided under “Measurement” will be paid for at the unit price bid. The prices shall be full compensation for furnishing all labor; for all materials; for all royalty and freight involved; for all hauling and delivering on the road; and for all tools, equipment and incidentals necessary to complete the work. Payment for unauthorized work will not be made.

Payment will be made under one of the following:

- 1. Topsoil (Method A) – Per Cubic Yard, Plan Quantity.
- 2. \_\_\_\_- Inch Topsoil (Method B) – Per Square Yard, Plan Quantity.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures

### PART 2 PRODUCTS

#### 2.1 TOPSOIL MATERIALS

- A. Topsoil:
  - 1. This material shall consist of approved topsoil material and shall be clean, friable, loamy soil capable of supporting plant life
  - 2. This material can be excavated and reused material from on-site sources, or imported from an approved off-site source.
  - 3. Reasonably free of roots, rocks larger than 2 inch, subsoil, debris, large weeds, and foreign matter.

4. Acidity range (pH) of 5.5 to 7.5.
5. Containing minimum of 4 percent and maximum of 25 percent organic matter.
6. Conforming to ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System). Group Symbol OH or PT.
7. Limit decaying matter to 10 percent of total content by volume.

## 2.2 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. When tests and/or observations indicate materials do not meet specified requirements, change material and retest.
- C. Furnish materials of each type from same source throughout the Work, unless otherwise approved by City. Off-site borrow sources shall be approved by the City.

## PART 3 EXECUTION

### 3.1 EXCAVATION

- A. Perform as specified in Section 31 23 16 - Excavation.

### 3.2 STOCKPILING

- A. Stockpile materials at locations designated or approved by City.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Stockpile topsoil to only a height which yields safe slope stability.
- E. Prevent intermixing of soil types or contamination.
- F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

### 3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.
- B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

### 3.4 PLACING TOPSOIL

- A. Eliminate uneven areas and low spots.
- B. Remove debris, roots, branches, and stones in excess of 2 inches in size.

- C. Scarify surface to depth of 4 inches where topsoil is scheduled.
- D. Place topsoil in areas where seeding and/or sodding is required to nominal depth of four inches (plus or minus ½ inch), or as indicated on the Drawings. For areas that will receive sod, leave topsoil low. Place topsoil during dry weather.
- E. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- F. Remove roots, weeds, rocks, and foreign material while spreading.
- G. Manually spread topsoil close to plant material, structures, water and wastewater appurtenances, concrete paving, and curbs to prevent damage.
- H. Lightly roll placed topsoil.
- I. Remove surplus topsoil from site.
- J. Leave stockpile area and site clean and raked, ready to receive seeding or sodding.
- K. Prohibit construction traffic over topsoil.

END OF SECTION



## SECTION 31 10 00 - CLEARING

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Removing and disposing of surface debris, rubbish, and other objectionable materials.
2. Removing and disposing of designated building slabs, paving, curbs, driveways, miscellaneous stone, brick, concrete, sidewalks, drainage structures, headwalls, safety end treatments, manholes, inlets, and abandoned railroad tracks.
3. Removing and disposing of designated fencing and signage.
4. Removing and disposing of designated trees, shrubs, and other plant life.
5. Removing and disposing of designated abandoned water and wastewater utilities and septic tanks.
6. Herbicide treatment
7. Excavating topsoil.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

##### A. Clearing:

1. Basis of Measurement: "Clearing," when included in the contract as a pay item, will be measured by the acre or by the linear foot (for the width of ROW and/or width of easement).
2. Basis of Payment: This item will be considered subsidiary to Section 31 23 16 - Excavation, unless included as a separate pay item in the contract. When included for payment, it shall be paid for at the unit price bid for "Clearing," which price shall be full compensation for all work herein specified, including the furnishing of all materials, equipment, tools, labor, hauling, legal disposal and incidentals necessary to complete the work. Herbicide shall be paid for herbicide application and furnishing equipment, material, labor, tools, re-treatment as necessary, and incidentals. Payment, when included as a contract pay item, will be made under the following:
  - a. Clearing (Method A) – Per Acre, Measured.
  - b. Clearing (Method B) – Per Linear Foot (width of ROW/width of easement), Plan Quantity.
  - c. Herbicide Treatment (Broadcast) – Per Lump Sum, Plan Quantity.
  - d. Herbicide Treatment (Basal Bark) – Per Lump Sum, Plan Quantity.
  - e. Herbicide Treatment (Cut-Stump) – Per Lump Sum, Plan Quantity.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

#### 1.4 QUALITY ASSURANCE

- A. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.
- B. Herbicide:

1. License Requirements: Possess either a commercial pesticide applicator license from the Texas Department of Agriculture, or a Texas Structural Pest Control Service License. Provide documentation of license before beginning work. Conduct on-site supervision of all mixing, transporting, handling, spraying, and disposal of materials with licensed personnel.
2. Records: Document work in accordance with all Federal, State, and Local regulations. Submit a copy of the herbicide records on the next business day following application. Submit a final copy of all the herbicide application records upon completion of the work.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Herbicide: Furnish herbicide materials in accordance with Section 15 of the 2017 TxDOT Herbicide Operations Manual.
- B. Pathfinder II, Transline, & Capstone are acceptable products that can be used in conjunction with each other.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify existing plant life designated to remain is tagged or identified.
- C. Identify spoils site for placing removed materials.

### 3.2 PREPARATION

- A. Call Texas 811 service at 800-344-8377 not less than three working days before performing Work.
  1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Prior to commencing this work, erosion control measures shall be in place.

### 3.3 PROTECTION

- A. Locate, identify, and protect structures and utilities indicated to remain, from damage.
- B. Areas within the construction limits or as indicated shall be cleared of all trees, stumps, brush, etc. as defined above; except trees or shrubs indicated for preservation which shall be carefully trimmed as directed, and shall be protected from scarring, barking or other injuries during construction operations. Exposed ends of pruned limbs or scarred bark shall be pruned, trimmed and treated with an approved asphaltic material within 24 hours of the pruning or injury.

- C. Locate, protect, and maintain benchmarks, monuments, control points, and project engineering reference points. Re-establishment of disturbed or destroyed items shall be by a Registered Professional Land Surveyor (licensed in the state of Texas), at no additional cost to Owner.
- D. Construction equipment shall not be operated within the drip line of trees, unless indicated. Construction materials shall not be stockpiled under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees until tree wells are constructed.

### 3.4 CLEARING

- A. Strip and remove from construction area all topsoil, organics, and vegetation to a minimum depth of 6 inches below the existing natural ground surface.
- B. Remove trees and shrubs within the construction limits unless noted otherwise in the Drawings. Remove stumps, main root ball, and root system. Holes remaining after the removal of all obstructions, objectionable materials, trees, stumps, etc. shall be backfilled with Select Fill and compacted in accordance with Section 31 23 23 - Fill.
- C. Clear undergrowth and deadwood, without disturbing subsoil.
- D. Apply herbicide to remaining stumps to inhibit growth.

### 3.5 REMOVAL

- A. Remove surface debris, rock, and extracted trees, shrubs and other plant life from site, or as indicated on Drawings.
- B. Remove designated building slabs, paving, curbs, driveways, miscellaneous stone, brick, concrete, sidewalks, drainage structures, headwalls, safety end treatments, manholes, inlets, and abandoned railroad tracks as indicated on Drawings. Neatly saw cut edges at right angle to surface.
- C. Remove designated fencing and signage.
- D. Remove abandoned water and wastewater utilities and septic tanks. Indicated removal termination point for underground utilities on Record Documents.
- E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- F. Do not burn or bury materials on site. Leave site in clean condition.

### 3.6 HERBICIDE TREATMENT

- A. Season: Spray herbicide during active growing periods unless otherwise approved.
- B. Equipment: Furnish all equipment.
  - 1. Broadcast application: furnish self-propelled equipment tractor mounted or pulled spray rigs with a low center of gravity that allows safe traverse on a maximum 3:1 slope.

- Provide equipment capable of making uniform broadcast application calibrated at a rate between 20 and 40 gallons per acre (GPA).
2. Basal Bark and Cut Tree applications: Furnish sprayers with low volume spray tips (spray system 5500 adjustable spray tip X-1 or X-2, or approved equivalent).
  3. Personal Protection Equipment: Follow the manufacturer's label requirements for personal protection of employees.
- C. Work Methods: Apply approved herbicide in accordance with the manufacturer's label recommendations, as shown on the drawings or as approved. Add surfactant and blue dye marker at the manufacturer's recommended rate unless otherwise approved. Prepare herbicide solution to the rates shown on the drawing using procedures on the herbicide container label. Dispose of empty containers and unused chemical mixtures in accordance with the label directions and local, state, and federal regulations. Cease spraying operation immediately when wind or other environmental conditions cause off-target spray drift, leaves are wet, or rainfall is imminent. An inspection of the treated areas will be made not less than 14 days and no later than 30 days after the application. Re-treat areas in which the undesirable vegetation has not been controlled for no additional compensation. Repair and replace any damaged desirable vegetation or erosion as a result of negligent applications.
1. Broadcast application: spray undesirable vegetation by broadcasting with spray nozzles at the desired rate. Ensure nozzles spray consistent across the area being covered.
  2. Basal Bark treatment: apply herbicide solution with a low-volume, low pressure sprayer which thoroughly wets the lower 12-15 in. of stems on all sides, including the root collar area, but not to the point of run-off. Perform application at any time throughout the year, except when the stumps are wet from rainfall or dew prevents spraying to the base of the plant.
  3. Cut-stump treatment: cut plants parallel to the ground, not to exceed 2 in. above the ground line. Apply the herbicide solution with a low-volume, low-pressure sprayer which thoroughly wets the area adjacent to the cambium and bark around the entire circumference of the stump. Thoroughly wet the sides of the stump, but not to the point of run-off. Make the herbicide application within 1 hr. from the time each plant is cut. Dispose of removed materials and debris at appropriate off-site locations in accordance with local, state, and federal requirements.
- D. City reserves the right to pay a partial payment of 50% of the lump sum price bid after the initial application is performed. The final 50% of the lump sum price bid will be paid after the inspection and required re-treatments have been completed and accepted.

### 3.7 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, relandscaped, regraded, or within the construction limits of a structure without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site to a height which yields safe slope stability and protect from erosion. Remove excess topsoil not intended for reuse, from project.

END OF SECTION

## SECTION 31 23 15 - TRENCH SAFETY SYSTEMS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Furnishing all equipment, materials and labor for a trench safety system meeting appropriate requirements established in Occupational Safety and Health Administration (OSHA) Safety and Health Regulations, 29 CFR Part 1926, OSHA Standards – Excavations; Final Rule, October 31, 1989. In the event of conflict of published and proposed rules, the more stringent requirement shall be used.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Trench Safety Plan:
  - 1. Basis of Measurement: Trench Safety Plan shall be measured by the lump sum for the project.
  - 2. Basis of Payment: Payment for Trench Safety Plan shall be made at the lump sum bid for “Trench Safety Plan.” Payment for all work prescribed under this item shall be full compensation for the Trench Safety Plan including acquisition of soils information and design of trench safety system, by a Professional Engineer registered in the State of Texas.
    - a. Trench Safety Plan – Per Lump Sum, Plan Quantity.
- B. Trench Safety Implementation:
  - 1. Basis of Measurement: Trench Safety Implementation shall be measured by the linear foot for the project.
  - 2. Basis of Payment: Payment for Trench Safety Implementation shall be made at the unit price bid for “Trench Safety Implementation.” Payment for all work prescribed under this item shall be full compensation for the Trench Safety System including any additional excavation and backfill required, for furnishing, placing, maintaining and removing all shoring, sheeting, or bracing; for dewatering or diversion of water; for all jacking and jack removal; and for all other labor, materials, tools, equipment, and incidentals necessary to complete the work.
    - a. Trench Safety Implementation – Per Linear Foot, Plan Quantity.

#### 1.3 REFERENCES

- A. Federal Occupational Safety and Health Administration (OSHA) Standards – 29 CFR, Part 1926, Subpart P, as amended, including Proposed Rules published in the Federal Register (Vol. 52, No. 72) on April 15, 1987; Sections 1926-650 through 1926-653.
- B. Texas Legislature House Bill No. 662 and House Bill No. 665 with regard to Trench Safety Systems.

#### 1.4 DEFINITIONS

- A. Trench: A trench shall be defined as a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width.

## 1.5 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

## 1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with OSHA Regulations, 29 CFR Part 1926, OSHA Standards.

## 1.7 QUALIFICATIONS

- A. Prepare Trench Safety Plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.
- B. Maintain one copy of OSHA Standards on site.

## PART 2 PRODUCTS

### 2.1 TIMBER

- A. Trench sheeting materials shall be a minimum of 2 inches in thickness, solid and sound, free from weakening defects such as loose knots and splits. Shoring timber sizes shall not be less than that called for on the Trench Safety Plan.

### 2.2 STEEL SHEET PILING

- A. Steel sheet piling and steel for stringers and cross braces shall conform to ASTM A36.

### 2.3 TRENCH BOXES

- A. Portable trench boxes shall be constructed of steel conforming to ASTM A36. Connecting bolts shall conform to ASTM A307. Welds shall conform to requirements of AWS Specification D1.1.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. Trench safety systems shall be constructed, installed and maintained in accordance with the design prepared by the Contractor's registered Professional Engineer licensed to practice in the State of Texas to prevent death or injury to personnel or damage to structures in or near these trench excavations. Materials excavated from trench to be stored no closer to the edge of trench than 1/2 the depth of the trench.

### 3.2 INSTALLATION

- A. Timber Sheeting: Installed in accordance with detail shown on drawings. Drive timber sheeting to a depth below trench bottom as shown on Drawings. Size of uprights, stringers and

cross bracing to be in accordance with details shown on Drawings. Place cross braces in true horizontal position, spaced vertically, and secured to prevent sliding, falling or kickouts.

- B. Steel Sheet Piling: Steel sheet piling of equal or greater strength may be substituted for timber trench shoring shown on the drawings. Contractor to provide certification that steel sheet piling substituted provides equal or greater protection than timber trench shoring shown on drawings. Certification of steel sheet piling to be provided by registered Professional Engineer. Drive steel sheet piling to a minimum depth below trench bottom as recommended by Contractor's registered Professional Engineer licensed to practice in Texas providing design. Place cross braces in true horizontal position, spaced vertically and secured to prevent sliding, falling or kickouts.
- C. Trench Boxes: Portable trench box to be substituted for timber trench shoring shown on Drawings shall be designed or the design checked by Contractor's registered Professional Engineer licensed to practice in Texas. Design trench box to provide equal or greater protection than timber trench shoring shown on Drawings. Certification of the design of trench boxes shall be provided by Contractor prior to its use on project. In cases where top of portable trench box will be below to top of trench, the trench must be sloped to an angle greater than the angle of repose for the soil conditions existing on the project. In areas where sloped trench will affect the integrity of existing structures, Contractor to protect structures prior to sloping trench.
- D. Trench Jacks: When trench jacks are used for cross bracing and/or stringers, the Contractor shall provide certification by a registered Professional Engineer licensed to practice in Texas that the trench jacks provide protection greater than or equal to the timber cross bracing shown on Drawings.

### 3.3 SUPERVISION

- A. Contractor shall provide competent supervisory personnel at each trench while work is in progress to ensure Contractor's methods, procedures, equipment and materials pertaining to the safety systems in this item are sufficient to meet requirements of OSHA Standards.

### 3.4 MAINTENANCE OF SAFETY SYSTEM

- A. The safety system shall be maintained in the condition as shown on Drawings or as specified by the Contractor's registered Professional Engineer licensed to practice in Texas. The Contractor shall take all necessary precaution to ensure the safety systems are not damaged during their use. If at any time during its use a safety system is damaged, personnel shall be immediately removed from the trench or excavation area and the safety system repaired. The Contractor shall take all necessary precautions to ensure no loads, except those included in the safety system design, are imposed upon the excavation.

### 3.5 REMOVAL

- A. Bed and backfill pipe to a point at least one foot above top of pipe prior to removal of any portion of trench safety systems. Bedding and backfill shall be in accordance to other applicable specification items. Backfilling removal of trench supports shall progress together from bottom of trench upward. Remove no braces or trench supports until all personnel have

evacuated the trench. Backfill trench to within 4 feet of natural ground prior to removal of entire trench safety systems.

### 3.6 FIELD QUALITY CONTROL

#### A. Section 01 40 00 - Quality Requirements.

END OF SECTION



## SECTION 31 23 16 - EXCAVATION

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Description: This item shall consist of excavating and properly utilizing or otherwise satisfactorily disposing of all excavated material, of whatever character, within the limits of the work indicated and the constructing, compacting, shaping and finishing of all earthwork on the entire project in accordance with the specification requirements herein outlined and in conformity with the required lines, grades and typical cross sections indicated or as directed by the City. **All excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.**
- B. Section Includes:
  - 1. Soil compaction.
  - 2. Excavating for structures and foundations.
  - 3. Excavating for paving, roads, and parking areas.
  - 4. Excavating for slabs-on-grade.
  - 5. Excavating for site structures.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Excavating Soil Materials:
  - 1. Basis of Measurement: All accepted excavation will be measured by Method A, B, or C as follows:
    - a. Method A: Measurement of the volume of excavation in cubic yards. The plan quantities for excavation will be used as the measurement for payment of this item.
    - b. Method B: Measurement of the area in square yards of surface area excavated as indicated. The plan quantities will be used as the measurement for payment of this item.
    - c. Method C: Measurement of the volume of excavation in cubic yards by the average end areas. Cross sectional areas shall be computed from the existing ground section to the established line of the subgrade as indicated for the limits of the right of way or other work limits shown, including parkway slopes and sidewalk areas.
  - 2. Basis of Payment: This item will be paid for at the contract unit price bid for "Excavation," as provided under measurement Method A, B, or C as included in the bid, which price shall be full compensation for all work herein specified, including subgrade preparation, unless specified otherwise and the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work. Payment will be made under one of the following:
    - a. Excavation (Method A) – Per Cubic Yard, Plan Quantity.
    - b. Excavation (Method B) – Per Square Yard, Plan Quantity.
    - c. Excavation (Method C) – Per Cubic Yard, Measured.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

## PART 2 PRODUCTS

Not Used.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Erosion control and tree protection measures shall be in place prior to commencing work.
- B. Construction equipment shall not be operated within the drip line of trees, unless indicated.
- C. Construction materials shall not be stockpiled under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees until tree wells are constructed as indicated on the Drawings.
- D. Call Texas 811 service at 800-344-8377 not less than three working days before performing Work.
  - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- E. Call Local Municipality(ies) not less than 2 weeks before performing Work.
  - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- F. Notify utility company(ies) to remove and relocate utilities as indicated on the Drawings.
- G. Protect utilities indicated to remain from damage.
- H. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.
- I. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

### 3.2 EXCAVATION

- A. All excavation shall be performed as specified herein and shall conform to the established alignment, grades and cross sections.
- B. Suitable excavated “on-site” materials (Subsoil Type S3) may be utilized, insofar as practicable and when the material meets the criteria outlined in Section 31 23 23 - Fill in constructing required embankments and “fill” areas.
- C. Materials with a Plasticity Index (PI) greater than the surrounding materials or with a moisture content greater than 2 percent in excess of optimum shall be classified as unsuitable and must be manipulated to meet the above criteria before use or be removed.

- D. Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as “Waste” and shall become the property of the Contractor. It shall become his sole responsibility to dispose of this material off the limits of the right of way in an environmentally sound manner at a permitted disposal site.
- E. When required by the Engineer, the Contractor will set “blue-tops” for the subgrade.
- F. Excavate subsoil to the final subgrade elevation(s) to accommodate structural foundations, slabs-on-grade, paving, site structures, and civil site facilities.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- H. Trim excavation. Remove loose matter.
- I. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume. Remove larger material as specified in Section 31 23 23 - Fill.
- J. Notify City of unexpected subsurface conditions.
- K. Correct areas over excavated with Structural Fill as specified in Section 31 23 23 - Fill.
- L. Remove excess and unsuitable material from site.
- M. Stockpile subsoil in area designated on site to depth not exceeding 8 feet and protect from erosion.
- N. Repair or replace items indicated to remain damaged by excavation.

### 3.3 SUBGRADE PREPARATION FOR STRUCTURES AND PAVEMENTS

- A. After final subgrade elevation has been achieved, the exposed subgrade soils (subsoils) shall be scarified to a minimum depth of 6 inches. Compaction of the subsoil shall be to a minimum of 95% and less than 100% of its maximum dry density when determined in accordance with ASTM D698, Method D, Standard Proctor. The subsoil shall be no less than its optimum moisture to no greater than 3 percentage points above its optimum moisture content at the time of testing. The moisture content shall be maintained until subsequent construction activities commence.

### 3.4 FIELD QUALITY CONTROL

- A. Sections 01 40 00 - Quality Requirements.
- B. Request inspection of excavation, subgrade preparation, and density controlled fill operations in accordance with Section 31 23 23 - Fill.

### 3.5 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

## SECTION 31 23 17 - TRENCHING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Description: This work shall include the furnishing of all labor, materials, tools, equipment and machinery necessary for clearing and removing from the site of the work wherever located, all obstructions, trees, stumps, brush, vegetation, woods and debris; and all earth, rock and other materials to be excavated; the removal of existing structures except where specifically paid for as separate contract pay items; the replacement of topsoil after backfilling is completed; the installation and operation of all pumping, bailing and draining necessary to keep the excavation free from seepage water, water from sewer, drains, ditches, creeks and other sources, and to provide for the uninterrupted flow of sewers and surface waters during progress of the construction; the satisfactory disposal of excess and unsuitable materials not required or which cannot be used for backfilling; compacting and refilling, after settlement of all excavated areas; the restoration of all streets, alleys, rights-of-way and other lands, private or public, damaged or occupied by the Contractor in the performance of the contract to the same (or improved) condition as they were prior to the beginning of the work.
- B. Section Includes:
  - 1. Excavating trenches for utilities.
  - 2. Compacted fill from top of embedment to subgrade elevations.
  - 3. Backfilling and compaction.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Trenching: Measurement and payment shall be considered subsidiary to the pipe construction for which it pertains.

#### 1.3 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

#### 1.4 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

#### 1.5 QUALIFICATIONS

- A. Prepare Trench Safety Plan as per Section 31 23 15 – Trench Safety Systems.

#### 1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to construction.

## 1.7 COORDINATION

- A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Embedment Material: The type of embedment to be used for storm sewers, sanitary sewers or water mains shall be one of the following:
  - 1. Coarse Aggregate Type A4 (Gravel for Trench Backfill) per Section 32 05 16 – Aggregates for Civil Site Improvements.
- B. Concrete Encasement: Shall consist of Class B concrete per Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- C. Trench Backfill:
  - 1. Backfill above embedment material (outside traffic areas): Excavated backfill material outside of traffic areas shall consist of an excavated material of gravel, fine rock cuttings, sandy loam, or clay having dimensions no greater than 2 inches, and compacted per applicable sections of this specification.
  - 2. Backfill above embedment material (beneath pavements):
    - a. Coarse Aggregate Type A4 (Gravel for Trench Backfill) per Section 32 05 16 - Aggregates for Civil Site Improvements and compacted as specified herein.

### 2.2 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, woven or non-woven, from the following manufacturers:
  - 1. U.S. Fabrics, Inc.
  - 2. Alkzo Nobel Geosynthetic Co.
  - 3. Huesker, Inc.
  - 4. TC Mirafi.
  - 5. Tenax Corp.
  - 6. Tensar Earth Technologies, Inc.

## PART 3 EXECUTION

### 3.1 LINES AND GRADES

- A. Construct the trenches to lines and grades indicated on Drawings.
  - 1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- B. Use laser-beam instrument with a qualified operator to establish lines and grades.

- C. Submit at least 6 copies of any layout plans from the pipe manufacturer for review and approval at least 30 days in advance of any actual construction of the project. The City will forward all comments of the review to the Contractor for revision. Revisions shall be made and forwarded to the City for his acceptance. Prior to commencement of the Project, reviewed layout plans will be sent to the Contractor marked for construction.
- D. Should the Contractor's procedures not produce a finished pipe placed to grade and alignment, the pipe shall be removed and relayed and the Contractor's procedures modified to the satisfaction of the City. No additional compensation shall be paid for the removal and relaying of pipe required above.

### 3.2 PREPARATION

- A. Call Texas 811 service at 800-344-8377 not less than three working days before performing Work.
  - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.
- F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

### 3.3 TRENCHING

- A. Site Preparation: The construction site shall be prepared for construction operations by the removal and disposal of all obstructions and objectionable materials from the designated construction area. Such obstructions and objectionable materials shall include the removal of designated trees, bushes, grass, miscellaneous stone, brick, concrete, scrap iron and all rubbish and debris whether above or below ground level. It is the intent of this specification to provide for the removal and disposal of all objectionable materials not specifically provided for elsewhere by the Drawings and specifications. The removal of such items shall be accomplished prior to grading and excavation operations. The removal and disposal of such items shall not be measured or paid for as a separate contract pay item. Such items shall be considered as incidental work and the cost thereof shall be included in such contract pay item as provided in the proposal and contract.
- B. Maintenance of Streets During Construction:
  - 1. Maintain the surfaces of streets being worked on at all times. The maintenance required shall include the filling of holes, blading or otherwise smoothing of the street surfaces (particularly the trench area), cleaning and removal of surplus excavation material, rubbish, etc., sprinkling of streets with water or abate dust nuisances and the elimination

of interference resulting from blocking the street to residents thereon. Any or all such operations shall be performed by the Contractor upon demand by the Owner, but the Contractor shall not wait for instruction from the Owner before performing maintenance work obviously in need of being done to meet the requirements of these specifications. All costs of work covered by this paragraph shall be included in the prices bid for the various items of work; and no separate payment shall be made.

2. In the event the Contractor fails or refuses to properly maintain the surfaces of streets on which he is working or has worked, the Owner, after due notice to the Contractor, shall perform the necessary maintenance. All costs to the Owner incurred in the performance of such work shall be deducted from any monies due or to become due to the Contractor for work performed, or the Contractor shall be billed for such costs directly as the Owner shall elect. Notice to the Contractor to be given by the Owner shall be in writing, and it shall be delivered to the Contractor or his authorized agent. Except in emergency cases, where immediate action is required, the Contractor shall have 24 hours in which to comply with the instructions of the Owner. Should the Contractor fail to do so, the Owner shall proceed with the work as set forth above.
3. Where traffic must cross open trenches, such as street intersections and driveways, the Contractor shall provide suitable backfill bridges, protective barricades and such other safety equipment as required. The use of machinery must be so regulated as to preclude any unnecessary interference with traffic, utilities, etc. The Contractor shall abide by all applicable federal, state or local laws governing excavation work.

C. Soil Borings: Whenever the Owner has caused certain test borings to be made on the site, or when any information pertaining of the character or depth of materials is found from observations, records or otherwise, such information revealed thereby may be provided to the Contractor. The action of the Owner in revealing such information shall not, in any manner, be construed as a warranty on the part of the Owner of the exact nature of the subsurface conditions that shall be encountered during construction of the work. Although the information is shown as accurately as possible, the Owner does not guarantee that any materials to be encountered at any point or points are even approximately the same, either in character or elevations, as those shown on the Drawings. The information thus furnished by the Owner is intended only as a guide to the Contractor in making his own investigations preliminary to submitting a bid for the work.

D. Existing Structures:

1. All existing structures, improvements and utilities shall be adequately protected, at the expense of the Contractor, from damage that might otherwise occur due to construction operations. Where construction comes in close proximity to existing structures or utilities, or if it becomes necessary to move services, poles, guy wires, pipe lines or other obstructions, the Contractor shall notify and cooperate with the utility or structure Owner. The utility lines and other existing structures shown on the Drawings are for information only and are not guaranteed by the Owner to be complete or accurate as to the location and/or depth. The Contractor shall be liable for damage to any utilities resulting from his operation. During construction, all fire hydrants, valve boxes and other existing utility controls shall be left intact, unobstructed and accessible as noted on the plan.
  - a. Relocation or Replacing Utilities: Unless noted on the Drawings that utilities are to be moved by others, any cost of temporarily or permanently relocating utilities shall be borne by the Contractor. The cost of these replacements shall be included in the Contractor's bid price for the various items of work; and no separate payment shall be made. In case damage to an existing structure or utility occurs, whether such



damage results directly or indirectly from the Contractor's operations, the Contractor shall be responsible to restore the structure or utility to its original condition and position without extra compensation. Temporary shut down of water and/or sewer services shall not extend overnight, holidays or weekends. The Owner shall approve all shut downs and may assist in the shut down operations.

- b. Sewer Services: All sewer services damaged during construction shall be replaced by the Contractor at his expense. Sewer service reconnections, including necessary adjustments to a sanitary sewer replacement, shall not require the services of a master plumber, if being replaced by a utility Contractor; however, in all cases, repair shall be inspected by the Owner. It shall be the responsibility of the Contractor to maintain such services throughout the construction process.
  - c. Water Services: Service lines shall not be removed during excavation; and the Contractor shall provide adequate support for the services across the open ditch.
  - d. Interrupted Service: Cuts or breaks in sewer mains and laterals, or service connections, shall be restored at the earliest practicable moment in order to give the least possible interruption in service. The Contractor shall be responsible for notifying customers of temporary interruption of service.
  - e. Other Utilities: All water mains, water services, sanitary sewers, sanitary sewer house laterals, storm sewers, power conduits, gas mains, gas service laterals and other appurtenances damaged during construction shall be repaired or replaced. Where the exact depth of any utility or obstruction is not shown on a plan, excavation shall be made prior to reaching the obstruction in order to determine adjustments in grade if needed to prevent interference. Redesign to eliminate conflicts may be necessary. Extra compensation shall not be paid for such delays. When it is necessary to remove or adjust another utility, a representative of that utility shall be notified to decide method and work to be done. The Contractor shall make satisfactory arrangements with other utilities for the required cutting or adjustments at the Contractor's own expense. Other than for items that may be provided in the contract for such work. No extra compensation shall be paid due to delays caused by removal of public utility structures.
  - f. Street Sign Posts and Signs: The Contractor shall be responsible for all damage to street sign posts and signs within the limits of his operations that remain in place or are removed and replaced. In the event that street sign posts and signs are damaged or destroyed by the Contractor's operations, they shall be replaced at the Contractors' expense.
  - g. Methods of Removal and Disposal: Materials or parts of structures which are to be broken up, dismantled or removed, and which are to be salvaged, shall be removed, loaded, cleaned and unloaded at sites designated by the Owner. Materials which are not designated to be salvaged shall become property of the Contractor; and he shall dispose of the material at his own cost and expense.
- E. Do not advance open trench more than 200 feet ahead of installed pipe, unless preapproved by City.
- F. Trench Width
- 1. Trenches for pipes less than 20 inches in diameter shall have a minimum width of 10 inches and a maximum width of 1 foot on each side beyond the outside surfaces of the pipe bell or coupling.

2. Trenches for pipes between 21 and 48 inches in diameter shall have a minimum width of 12 inches and a maximum width not to exceed one pipe diameter on each side beyond the outside surfaces of the pipe.
3. Trenches for pipes 54 inches in diameter and larger shall have a minimum width of 15 inches and a maximum width of one pipe diameter beyond the outside surfaces of the pipe.
4. If trench width within the pipe zone exceeds this maximum, the entire pipe zone shall be refilled with approved backfill material, thoroughly compacted to a minimum of 95 percent of maximum density and then re-excavated to the proper grade and dimensions. Excavation along curves and bends shall be so oriented that the trench and pipe are approximately centered on the centerline of the curve, using short links for pipe and/or bend fillings if necessary.
5. For all utilities to be constructed in fill above natural ground, the embankment shall first be constructed to an elevation not less than 1 foot above the top of the utility after which excavation for the utility shall be made as indicated.

G. Alternative Trench Width for Use with Free-Flowing Granular Embedment Material

1. Based upon preapproval by City, Contractor may use the alternative trench widths in conjunction with free-flowing granular embedment material. The minimum and maximum alternative trench widths are specified below; however, in most instances the minimum trench width shall be that width which is sufficient to insure working space between the outside surface of the pipe and the trench wall to safely place trench safety equipment and to properly place and compact the embedment materials.
  - a. Trenches for pipes less than 18 inches in diameter shall have a minimum width of 8 inches and a maximum width of 24 inches on each side beyond the outside surfaces of the pipe bell or coupling.
  - b. Trenches for pipes 18 inches in diameter or greater shall have a minimum width of 6 inches and a maximum width not to exceed one pipe diameter on each side beyond the outside surfaces of the pipe.

H. Trench Depth and Depth of Cover

1. All pipe and in-line appurtenances shall be laid to the grades indicated. The depth of cover shall be measured from the established finish grade, natural ground surface, subgrade for staged construction, street or other permanent surface to the top or uppermost projection of the pipe.
  - a. Where not otherwise indicated, all water piping shall be laid to the following minimum depths:
    - 1) Water piping installed in undisturbed ground in easements of undeveloped areas which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 42 inches of cover.
    - 2) Water piping installed in existing streets, roads or other traffic areas shall be laid with at least 42 inches of cover below finish grade.
2. Provide uniform and continuous bearing and support for bedding material and pipe.

I. Classification of Excavation: Excavation will not be considered or paid for as a separate item of work, so excavated material will not be classified as to type or measured as to quantity. Full payment for all excavation required for the construction shall be included in the various unit or lump sum contract prices for the various items of work installed, complete in place. No extra compensation, special treatment or other consideration will be allowed due to rock, pavement,

caving, sheeting and bracing, falling or rising water, working under and in the proximity of trees or any other handicaps to excavation.

- J. Dewatering Excavation: Underground piped utilities shall not be constructed or the pipe laid in the presence of water. All water shall be removed from the excavation prior to the pipe placing operation to insure a dry firm granular bed on which to place the underground piped utilities and shall be maintained in such unwatered condition until all concrete and mortar is set. Removal of water may be accomplished by bailing, pumping or by a well-point installation as conditions warrant.  
In the event that the excavation cannot be dewatered to the point where the pipe bedding is free of mud, a seal shall be used in the bottom of the excavation. Such seal shall consist of lean concrete with a minimum depth of 3 inches.
- K. Trench Conditions:
1. Before attempting to lay pipe, all water, slush, debris, loose material, etc., encountered in the trench must be pumped or bailed out and the trench must be kept clean and dry while the pipe is laid and backfilled. Where needed, sump pits shall be dug adjoining the trench and pumped as necessary to keep the excavation dewatered.
  2. Backfilling shall closely follow pipe laying so that no pipe is left exposed and unattended after initial assembly. All open ends, outlets or other openings in the pipe shall be protected from damage and shall be properly plugged and blocked watertight to prevent the entrance of trench water, dirt, etc. The interior of the pipeline shall at all times be kept clean, dry and unobstructed.
  3. Where the soil encountered at established footing grade is a quicksand, saturated or unstable material, the following procedure shall be used unless other methods are indicated:
    - a. All unstable soils shall be removed to a depth of 2 feet below bottom of piped utility. Such excavation shall be carried out to the trench widths above.
    - b. All unstable soil so removed shall be replaced with concrete seal foundation rock for the entire trench width or coarse aggregate materials placed in uniform layers not to exceed 6 inches, loose measure and compacted by mechanical tamping or other means which will provide a stable foundation for the utility.
    - c. All forms, concrete seals, sheathing and bracing, pumping, additional excavation and backfill required shall be done at the Contractor's expense.
- L. Trench sidewalls shall be sloped, or sheeting and/or shoring shall be used in accordance with the Trench Safety Plan in order to provide safety and protection in, and to, the excavation.
- M. Trim excavation. Remove loose matter.
- N. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with lean concrete, or Flexible Base as directed by City.
- O. Removing Old Structures: When out of service masonry structures or foundations are encountered in the excavation, such obstructions shall be removed for the full width of the trench and to a depth of 1 foot below the bottom of the trench. When abandoned inlets or manholes are encountered and no plan provision is made for adjustment or connection to the new sewers, such manholes and inlets within the construction limits shall be removed completely to a depth of 1 foot below the bottom of the trench. In each instance, the bottom of the trench shall be restored to grade by backfilling and compacting by the methods provided

above. Where the trench cuts through storm or wastewater sewers which are known to be abandoned, these sewers shall be cut flush with the sides of the trench and blocked with a concrete plug in a manner satisfactory to the City. When old structures are encountered, which are not visible from the existing surface and are still in service, they shall be protected and adjusted as required to the finished grade.

- P. Excess material or material which cannot be made suitable for use in embankments will be declared surplus by the City and shall become the property of the Contractor to dispose of off site at a permitted fill site, without injury to the City or any individual. Such surplus material shall be removed from the work site promptly following the completion of the portion of the utility involved.
- Q. Stockpile subsoil in area designated on site to only a height which yields safe slope stability and protect from erosion.

### 3.4 SHEETING AND SHORING

- A. All excavations for trenches, structures, etc. 5 feet in depth or greater are required to have a Trench Safety Plan prepared and sealed by a Registered Professional Engineer in the State of Texas in accordance with OSHA requirements and Section 31 23 15 – Trench Safety Systems of the specifications.
- B. Submit Trench Safety Plan prior to any excavation.
- C. When specified in the Drawings, sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished grade. Otherwise, sheeting and shoring shall be removed at completion of excavation work.
- D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

### 3.5 PIPE BEDDING AND EMBEDMENT

- A. Where not otherwise provided, all piping shall be installed in a continuous envelope of embedment material meeting the requirement of materials specified herein.
- B. Embedment material shall extend from 6 inches below (bedding) to 12 inches above the outer parts of the pipe (unless indicated otherwise), fittings and accessories for pipe.
- C. All bracing, struts, etc., installed by the pipe manufacturer (or temporary replacements by the Contractor) shall be kept in place in the pipe, undisturbed, until the trench has been backfilled at least to the top of the pipe. When installing mortar lined and mortar coated steel pipe, all bracings, struts, etc., installed by the pipe manufacturer shall be kept in the pipe, undisturbed until the pipe has been backfilled.

### 3.6 BACKFILLING

- A. Backfill Procedure: Backfill procedure is that procedure required to return trenched or excavated areas to a condition satisfactory to the City. Such backfilling occurs in two general areas. They are 1) areas not subjected to vehicular traffic; and 2) areas subjected to, or influenced by, vehicular traffic.

The methods of backfilling to be used shall vary with the width of trench, the character of the materials excavated, the method of excavation, the type of conduit and the degree of compaction required. The placing of backfill shall not begin until the pipe structure has been properly bedded and jointed.

1. Trench backfill material is the material required to fill the trench from the top of the embedment to ground elevation or subgrade of a pavement or structure.
- B. Backfill trenches to contours and elevations with unfrozen fill materials.
- C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- D. Place geotextile fabric when specified in the Drawings.
- E. Place fill material in continuous layers and compact to the density specified herein.
- F. Employ placement method that does not disturb or damage utilities in trench.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Do not leave more than 50 feet of trench open at end of working day, unless preapproved by City.
- I. Protect open trench to prevent danger to the Owner, the public, and users of the Project site.

### 3.7 COMPACTION

- A. Compaction of all bedding, embedment, and backfill materials shall be performed in a manner that shall not crack, crush and/or cause the installed pipe to be moved from the established grade and/or alignment, as shown on the Drawings. Satisfactory density shall be obtained at various depths on all backfill material as indicated from random selected test points prior to the required exfiltration or pressure tests that are to be performed on lines being constructed. The required moisture content shall be at not less than 2 percent below nor more than 4 percent above the optimum moisture of the material or as specified by the City.
- B. Densities for Bedding and Embedment:
1. Coarse Aggregate Type A1 (Flexible Base) embedment shall be mechanically compacted in 6 inch lifts to a minimum of 95 percent Standard Proctor Density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)), unless indicated otherwise on Drawings.
  2. Coarse Aggregate Type A2 (Crushed Stone) embedment shall be mechanically compacted in 6 inch lifts to a minimum of 95 percent of Maximum Dry Density in accordance with TEX-113-E - , unless indicated otherwise on Drawings.

3. Coarse Aggregate Type A4 (Gravel Trench Backfill) embedment shall be mechanically compacted in 6 inch lifts to a minimum of 95 percent Standard Proctor Density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)), unless indicated otherwise on Drawings.

- C. Backfill Densities – Areas Subjected to or Influenced by Vehicular Traffic: The trench backfill shall be mechanically compacted to the top of the subgrade in 6 inch loose lifts to at least 95 percent of maximum density as determined by ASTM D698 -Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>), at, or above, optimum moisture content.
- D. Backfill Densities – Areas Not Subjected to or Influenced by Vehicular Traffic: The trench backfill shall be placed in layers not more than 10 inches loose depth and shall be compacted by mechanical means. Compaction methods to at least 90 percent of maximum density as determined by ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>), at, or above, optimum moisture content.

### 3.8 TOLERANCES

- A. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch (0.08 feet) from required elevations.
- B. Top Surface of General Backfilling: Plus or minus 1 inch (0.08 feet) from required elevations.

### 3.9 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

### 3.10 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

## SECTION 31 23 23 - FILL

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Description: This item shall consist of the placing and compacting of suitable materials obtained from approved sources for utilization in the construction of civil site improvements.
- B. Section Includes:
  - a. Fill under structural foundations.
  - b. Fill for embankment for construction of highways, streets, and pavements.
  - c. Fill for the construction of earthen embankments, berms, levees, dikes, and structures.
  - d. Fill for over-excavation.
  - e. Backfilling perimeter of manholes and utility structures to subgrade elevations.
  - f. Backfilling site structures to subgrade elevations.
  - g. Backfilling pipeline trenches.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Basis of Measurement: All accepted fill (of the Type specified), when included in the contract as a separate pay item, will be measured by the cubic yard in its final position based upon the average end areas taken from pre-construction cross sections and plan grades. The plan quantities will be used as the measurement for payment for this item.
- B. Basis of Payment: This item is usually subsidiary to excavation and/or subsoils and is not paid for separately. However, when included in the contract as a separate pay item, it shall be paid for at the contract unit price bid for "Fill," which price shall be full compensation for all work herein specified, including the furnishing of all materials (except "Subsoils" when paid as a separate bid item), compacting, equipment, tools, labor, water for sprinkling, proof rolling and incidentals necessary to complete the work. Payment, when included in the contract as a separate pay item, will be made under:
  - a. Select Fill (Type S1; Select Fill, or Select Borrow) – Per Cubic Yard, Plan Quantity.
  - b. Fill (Type S2; Borrow) – Per Cubic Yard, Plan Quantity.
  - c. Fill (Type S3; On-Site Material) – Per Cubic Yard, Plan Quantity.
  - d. Structural Fill (Coarse Aggregate Fill, Type A1; Flexible Base) – Per Cubic Yard, Plan Quantity.
  - e. Fill (Coarse Aggregate Fill, Type A2; Crushed Stone) – Per Cubic Yard, Plan Quantity.
  - f. Fill (Coarse Aggregate Fill, Type A3; Gravel Base) – Per Cubic Yard, Plan Quantity.
  - g. Fill (Coarse Aggregate Fill, Type A4; Gravel for Trench Backfill) – Per Cubic Yard, Plan Quantity.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

## PART 2 PRODUCTS

### 2.1 FILL MATERIALS

- A. Subsoil Fill: All subsoil fill shall conform to the following material types:
  - a. Select Fill Type S1 (Select Fill, or Select Borrow): This material shall consist of sand or other suitable granular material, free from vegetation or deleterious or objectionable matter reasonably free from lumps of earth and when tested by standard TxDOT laboratory methods, shall meet the following requirements:
    - 1. The Liquid Limits shall not exceed 35.
    - 2. The Plasticity Index shall not be less than 4 nor more than 15.
    - 3. Minimum and maximum passing No. 200 sieve: 10% and 70%, respectively.
    - 4. No rocks greater than 2 inches in diameter.
  - b. Subsoil Type S2 (Borrow):
    - 1. This material shall consist of suitable nonswelling (soils with plasticity index less than 20) earth material such as loam, clay or other such materials that will form a stable embankment.
    - 2. This material shall be free of lumps larger than 3 inches in diameter, and rocks larger than 4 inches in diameter.
  - c. Subsoil Type S3 (On-Site Material):
    - 1. This material shall be excavated from on-site and re-used for fills (embankment).
    - 2. This material shall be free of lumps larger than 3 inches in diameter, and rocks larger than 4 inches in diameter.
- B. Structural Fill: Coarse Aggregate Type A1 (Flexible Base) as specified in 32 11 23 – Flexible Base.
- C. Coarse Aggregate Fill: Coarse Aggregate Type A2 (Crushed Stone); Coarse Aggregate Type A3 (Gravel Base Coarse); Coarse Aggregate Type A4 (Gravel for Trench Backfill); as specified in Section 32 05 16 – Aggregates for Civil Site Improvements.

### 2.2 ACCESSORIES

- A. Geotextile Fabric: Products and execution shall be specified in the drawings. Non-biodegradable, woven or non-woven.

## PART 3 EXECUTION

### 3.1 SUBGRADE PREPARATION FOR STRUCTURES AND PAVEMENTS

- A. Strip and remove from the construction area any topsoil, organics, and vegetation to a minimum depth of 6 inches below the existing, natural ground surface in accordance with Section 31 10 00 - Clearing.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to the density specified herein.



- C. Compact the subgrade (subsoil) in accordance with Section 31 23 16 – Excavation prior to commencing with subsequent “fill” operations.
- D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

### 3.2 EMBANKMENT/FILLING

- A. Prior to placing any embankment (fill), all tree protection, tree wells and erosion control devices shall be in place and all “Clearing” operations shall have been completed on the areas over which the embankment (fill) is to be placed. Stump holes or other small excavations in the limits of the embankments shall be backfilled with suitable material and thoroughly tamped by approved methods before commencing embankment construction. The surface of the ground, including plowed loosened ground or surface roughened by small washes, shall be restored to approximately its original slope and the ground surface thus prepared shall be compacted by sprinkling and rolling.
- B. Construction equipment shall not be operated within the drip line of the trees, unless indicated. Construction materials shall not be stockpiled under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees unless indicated.
- C. Unless otherwise indicated, the surface of the ground of all unpaved areas, other than rock which are to receive embankment (fill), shall be loosened by scarifying or plowing to a depth of not less than 4 inches. The loosened material shall be recompacted with the new embankment as hereinafter specified.
- D. The surface of hillsides to receive embankment (fill) shall be loosened by scarifying or plowing to a depth of not less than 4 inches and benches cut before embankment materials are placed. The embankment shall then be placed in layers, as hereinafter specified, beginning at the low side in partial width layers and increasing the widths as the embankment is raised. The material which has been loosened shall be recompacted simultaneously with the embankment material placed at the same elevation.
- E. Where embankments are to be placed adjacent to or over existing roadbeds, the roadbed slopes shall be plowed or scarified to a depth of not less than 6 inches and the embankment built up in successive layers, as hereinafter specified, to the level of the old roadbed before its height is increased. Then, if indicated, the top of the old roadbed shall be scarified and recompacted with the next layer of the new embankment. The total depth of the scarified and added material shall not exceed the permissible layer depth.
- F. Trees, stumps, roots, vegetation or other unsuitable materials shall not be placed in embankment (fill).
- G. All embankment shall be constructed in layers approximately parallel to the finished grade and unless otherwise indicated.
- H. The embankment (fill) shall be continuously maintained at its finished section and grade until that portion of the work is accepted. After completion of the embankment to the finished section and grade, the Contractor shall proof roll the subgrade and revegetation procedures must commence immediately to minimize the soil loss and air pollution.

- I. Except as otherwise indicated, embankments (fills) shall be constructed in successive 6 inch layers, loose measure, for the full width of the individual cross section and in such length as are best suited to the sprinkling and compaction methods utilized.
- J. Minor quantities of rocks not larger than 4 inches, encountered in constructing earth embankment may be incorporated in the earth embankment layers, provided such placement of rock is not within 10 feet of any structure.
- K. Each layer of embankment shall be uniform as to material, density and moisture content before beginning compaction. Where layers of unlike materials abut each other, each layer shall be feathered on a slope of 1:20 or the material shall be so mixed as to prevent abrupt changes in soil. No material placed in the embankment by dumping in a pile or windrows shall be incorporated in a layer in that position, but all such piles or windrows shall be moved by blading or similar methods. Clods or lumps of material shall be broken and the embankment material mixed by blading, harrowing, discing or similar methods to the end that a uniform material of uniform density is secured in each layer.
- L. Water required for sprinkling to bring the material to the moisture content necessary for optimum compaction shall be evenly applied and it shall be the responsibility of the Contractor to secure a uniform moisture content throughout the layer by such methods as may be necessary.
- M. All cuts, whether full width or partial width cuts in the side of a hill, which are not required to be excavated below subgrade elevation shall be scarified to a uniform depth of at least 6 inches below grade and the material shall be mixed and reshaped by blading and then sprinkled and rolled in accordance with the requirements outlined above for earth embankments and to the same density as that required for the adjacent embankment.
- N. Compaction of embankments (fills) shall be to a minimum of 95% and less than 100% of its maximum dry density when determined in accordance with ASTM D698, Method D, Standard Proctor, unless indicated otherwise on Drawings. The subsoil shall be no less than its optimum moisture to not greater than 3 percentage points above its optimum moisture content at the time of testing. After each layer of earth embankment (fill) is complete, density tests as necessary will be made. If the material fails to meet the density specified, the course shall be reworked as necessary to obtain the specified compaction.
- O. Embankment (fill) shall slope away from building minimum 5 percent slope for minimum distance of 10 ft, unless noted otherwise.
- P. Grade changes in embankment (fill) shall be made with gradual grade changes. Blend slope into level areas and remove surplus fill materials from site.

### 3.3 BACKFILLING

- A. As soon as practicable, all portions of excavation not occupied by the permanent structure shall be backfilled. Backfill material shall comply with "Subsoil Fill" as specified herein.
- B. That portion of backfill which will not support any portion of completed structure, roadbed, or embankment shall be placed in layers not more than 10 inches in depth (loose measurement) and shall be compacted in accordance with Paragraph 3.4, "Compaction" for "Subsoil Fill."

- C. That portion of the backfill which will support any portion of the structure, roadbed, or embankment shall be placed in uniform layers not more than 8 inches in depth (loose measurement) and shall be compacted in accordance with Paragraph 3.5, "Compaction" for "Subsoil Fill" and shall be compacted to that density by means of mechanical tampers or rammers, except that the use of rolling equipment of the type generally used in compaction embankments will be permitted on portions which are accessible to such equipment. All portions of embankment too close to any portion of a structure to permit compaction by the use of the blading and rolling equipment used on adjoining sections of embankment, shall be placed and compacted in the same manner as specified above for backfill material. Unless otherwise indicated, hand tamping will not be accepted as an alternate for mechanical compaction. As a general rule, material used in filling or backfilling the portions described in this paragraph shall be "Subsoil Fill," free of any appreciable amount of gravel or stone particles larger than 4 inches in greater dimension and of a gradation that permits thorough compaction. When required by the Drawings or by written order of the City, structural fill or coarse aggregate material shall be used for backfilling.

### 3.4 COMPACTION

- A. Subsoil Fill:
- a. Select Type S1 (Select Fill, or Select Borrow): Compaction shall be to a dry density of at least 95 percent Standard Proctor maximum dry density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)) and shall be within the range of the materials optimum moisture content to 3 percentage points above the materials optimum moisture content. Placement shall be in lifts not exceeding 8 inches before compaction.
  - b. Type S2 (Borrow) and Subsoil Type S3 (On-Site Material): Compaction shall be to a dry density of at least 95 percent Standard Proctor maximum dry density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)) and shall be within the range of the materials optimum moisture content to 2 percentage points above or below the materials optimum moisture content. Placement shall be in lifts not exceeding 8 inches before compaction.
- B. Structural Fill, Coarse Aggregate Type A1 (Flexible Base): Flexible Base material used as structural fill beneath foundations and for backfilling structures shall be placed in loose lifts not exceeding 8 inches before compaction, and shall be compacted mechanically to a minimum 98 percent of Standard Proctor dry density (ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)) and within two percentage points of the materials optimum moisture content, unless indicated otherwise on Drawings.
- C. Coarse Aggregate Fill
- a. Coarse Aggregate Type A2 (Crushed Stone): Compaction shall be a minimum of 95 percent of the maximum dry density in accordance with TxDOT Test Method TEX-113-E, unless indicated otherwise on Drawings.
  - b. Coarse Aggregate Type A3 (Gravel Base Course): Gravel Base Course used as structural fill beneath foundations and for backfilling structures shall be placed in loose lifts not exceeding 8 inches before compaction, and shall be compacted mechanically to a minimum 95 percent of Standard Proctor dry density (ASTM D698) and within two percentage points of the materials optimum moisture content, unless indicated otherwise on Drawings.

- c. Coarse Aggregate Type A4 (Gravel Trench Backfill): Gravel Trench Backfill shall be placed in loose lifts not exceeding 8 inches before compaction, and shall be compacted mechanically to a minimum 95 percent of Standard Proctor dry density (ASTM D698) and within two percentage points of the materials optimum moisture content.

### 3.5 TOLERANCES

- A. Top Surface of Fill Under Paved Areas: Plus or minus 0.50 inches from required elevations.
- B. Top Surface of General Grading of Fill: Plus or minus 0.10 feet from required elevations.

### 3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- C. Proof roll compacted fill surfaces under paving and sidewalks. Soft spots shall be removed, replaced, and retested.

### 3.7 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

## SECTION 31 23 24 - FLOWABLE FILL

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Flowable fill for:
    - a. Structure backfill.
    - b. Utility bedding.
    - c. Utility backfill.
    - d. Filling abandoned utilities.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Flowable Fill:
  - 1. Basis of Measurement:
    - a. Flowable Fill (Excavatable Type) – Per Cubic Yard.
    - b. Flowable Fill (Non-excavatable Type) – Per Cubic Yard.
  - 2. Basis of Payment: Includes furnishing flowable fill and installing where required. Measured quantities shall be taken from batch plant ticket.
    - a. Flowable Fill (Excavatable Type) – Per Cubic Yard, Plan Quantity.
    - b. Flowable Fill (Excavatable Type) – Per Cubic Yard, Measured.
    - c. Flowable Fill (Non-excavatable Type) – Per Cubic Yard, Plan Quantity.
    - d. Flowable Fill (Non-excavatable Type) – Per Cubic Yard, Measured.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

#### 1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section.

#### 1.5 FIELD MEASUREMENTS

- A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

## PART 2 PRODUCTS

### 2.1 FLOWABLE FILL

- A. Flowable Fill - Excavatable Type: Lean cement concrete fill used where future excavation may be required such as fill for utility trenches, bridge abutments, and culverts.
- B. Flowable Fill - Non-excavatable Type: Lean cement concrete fill used where future excavation is not anticipated such as fill below structure foundations and filling abandoned utilities.

### 2.2 MATERIALS

- A. Portland Cement: ASTM C150 (Standard Specification for Portland Cement) Type I - Normal; Type IA - Air Entraining; Type II - Moderate.
- B. Fine Aggregates: ASTM C33 – Standard Specification for Concrete Aggregates.
- C. Water: Clean and not detrimental to concrete.

### 2.3 MIXES

- A. Mix and deliver flowable fill in accordance with ASTM C94 - Standard Specification for Ready-Mixed Concrete, Option C.

| Flowable Fill Design Mix:<br>ITEM            | EXCAVATABLE      | NON-EXCAVATABLE |
|----------------------------------------------|------------------|-----------------|
| Cement Content                               | 75-100 lbs/cy    | 100-150 lbs/cy  |
| Water Content                                | Per mix design   | Per mix design  |
| 28 Day Compressive<br>Strength               | Maximum 150 psi. | Minimum 250 psi |
| Unit Mass (Wet)                              | 80-110 pcf       | 100-125 pcf     |
| Temperature, Minimum at<br>point of delivery | 50 degrees F     | 50 degrees F    |

- B. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.

### 2.4 SOURCE QUALITY CONTROL

- A. Test and analyze properties of flowable fill design mix and certify results for the following:
  - 1. Design mix proportions by weight of each material.
  - 2. Fine Aggregate: ASTM C33 – Standard Specification for Concrete Aggregates - for material properties and gradation.
  - 3. Properties of plastic flowable fill design mix including:
    - a. Temperature.
    - b. Slump.
    - c. Wet unit mass.

- d. Yield.
- e. Cement factor.
- 4. Properties of hardened flowable fill design mix including:
  - a. Compressive strength at 1 day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.
  - b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify excavation and trenching is complete.
- C. Verify utility installation is complete and tested before placing flowable fill.
- D. Verify excavation is dry and dewatering system is operating.

### 3.2 PREPARATION

- A. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.
- B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.
- C. Protect utilities and foundation drains to prevent intrusion of flowable fill.

### 3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

- A. Place flowable fill by chute, pumping or other methods approved by City.
  - 1. When required, place flowable fill under water using tremie procedure.
  - 2. Do not place flowable fill through flowing water.
- B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.
- C. Place flowable fill evenly on both sides of utilities to maintain alignment.
- D. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

### 3.4 INSTALLATION - FILLING ABANDONED UTILITIES

- A. Verify pipes and conduits are not clogged and are sufficiently empty to permit gravity installation of flowable fill for entire length indicated to be filled.

- B. Seal lower end of pipes and conduits by method to contain flowable fill and to vent trapped air caused by filling operations.
- C. Place flowable fill using method to ensure there are no voids.
  - 1. Fill pipes and conduits from high end.
  - 2. Fill manholes, tanks, and other structures from grade level access points.
- D. After filling pipes and conduits seal both ends.

### 3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.
  - 1. Test Requirements:
    - a. Minimum temperature at point of delivery.
    - b. Compressive strength requirements for each type of fill.
- C. Submit delivery tickets indicating actual materials delivered to Project site. Delivery tickets shall contain project description, date, time, class and quantity of mix, actual batch proportions, free moisture content of aggregate and quantity of water withheld.

### 3.6 CLEANING

- A. Remove spilled and excess flowable fill from Project site.
- B. Restore facilities and site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION



## SECTION 31 25 12 – STORM WATER POLLUTION PREVENTION

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR 150000, latest issue date (the Construction General Permit).
2. Implementation, maintenance inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices.
3. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with City prior to start of construction.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

##### A. Storm Water Pollution Prevention Plan:

1. Basis of Measurement: Lump Sum.
2. Basis of Payment: Payment for Storm Water Pollution Prevention Plan shall be made at the lump sum bid for "Storm Water Pollution Prevention Plan." Payment for all work prescribed under this item shall be full compensation for the Storm Water Pollution Prevention Plan including all preparation, submittals, notices, updates, and revisions.

##### B. Storm Water Pollution Prevention Plan Implementation:

1. Basis of Measurement: Lump Sum.
2. Basis of Payment: Includes all aspects of implementing the SWP3, from Notice of Intent through Notice of Termination.

#### 1.3 REFERENCES

##### A. Construction General Permit (TPDES No. TXR 150000).

##### B. Clean Water Act.

#### 1.4 SUBMITTALS

##### A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

#### 1.5 QUALITY ASSURANCE

##### A. Perform Work in accordance with the SWP3 as per the submission of the Notice of Intent.

##### B. Maintain one copy of the SWP3 document on site.

## PART 2 PRODUCTS – Not Used.

## PART 3 EXECUTION

### 3.1 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

- A. Fulfill all TPDES Construction General Permit (TXR 150000) requirements.
- B. Contractor shall fulfill the role of Primary Operator as defined by the TPDES Construction General Permit (TXR 150000) for this project.
- C. Prepare and submit all required documentation and pay all applicable fees to TCEQ required by the TPDES Construction General Permit (TXR 150000). This includes but is not limited to Notice of Intent, Site Notices, Notice of Termination, and Notification of MS4 Operator.
- D. SWP3:
  - 1. Prepare a SWP3 following Part III of the TPDES Construction General Permit (TXR 150000).
  - 2. Update or revise the SWP3 as needed during the construction following Part III, Section E of the TPDES Construction General Permit (TXR 150000).
  - 3. Submit the SWP3 and any updates or revisions to the City for review and address comments prior to commencing, or continuing, construction activities.
  - 4. Conduct inspections in accordance with TPDES Construction General Permit (TXR 150000).
  - 5. Maintain copies of SWP3, inspection reports, and other documentation as required by TPDES Construction General Permit (TXR 150000).

### 3.2 SWP3 IMPLEMENTATION

- A. Implement SWP3 utilizing state of the art Best Management Practice controls as required by the Construction General Permit, the site specific SWP3, and local government.
- B. Inspect and maintain controls throughout the course of construction per the Construction General Permit requirements.
- C. Remove controls per the Construction General Permit requirements.
- D. On-Site Waste Material Storage:
  - 1. Self-contain on-site waste material storage and satisfy appropriate location, state, and federal rules and regulations.
  - 2. Prepare list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of updated list with the SWP3.
  - 3. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

END OF SECTION

## SECTION 31 32 15 - LIME TREATMENT

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Preparing and treating the subgrade, existing subbase or existing base by pulverizing, furnishing and applying lime, mixing and compacting the mixed material to the required density. This item applies to natural ground, embankment or existing pavement structure and shall be constructed as specified herein and in conformity with the typical sections, lines and grades or as indicated.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

##### A. Lime Treatment:

1. Basis of Measurement: Lime treatment of the type, depth and rate of application on the subgrade, existing subbase and existing base shall be measured by the square yard to neat lines as shown on the typical sections. Lime material shall be measured by the ton (2,000 lbs) dry weight as calculated from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.
2. Basis of Payment: Work performed and materials furnished as prescribed by this item and measured as provided under "Measurement," will be paid for as follows:
  - a. "Lime Treated Subgrade" will be paid for at the unit price bid per square yard.
  - "Commercial Lime Slurry" will be paid at the unit price bid per ton. The unit price bid shall each be full compensation for preparing the roadbed; for furnishing all materials; for all freight involved; for public scales weighing charges or for furnishing scales and labor involved in weighing the material; for loosening, mixing, pulverizing, spreading, drying, furnishing and application of lime, sprinkling, rolling, shaping, proof rolling, maintaining and for all manipulations, labor, equipment, fuels, tools and incidentals necessary to complete the work. Payment will be made under the following:
    - 1) \_\_\_\_ -Inch Lime Treated Existing Subgrade – Per Square Yard, Plan Quantity.
    - 2) \_\_\_\_ -Inch Lime Treated Existing Subgrade – Per Square Yard, Measured.
    - 3) \_\_\_\_ -Inch Lime Treated Subsoil Type S3 – Per Square Yard, Plan Quantity.
    - 4) \_\_\_\_ -Inch Lime Treated Subbase or Base – Per Square Yard, Plan Quantity.
    - 5) \_\_\_\_ -Inch Lime Treated Subbase or Base – Per Square Yard, Measured.
    - 6) Commercial Lime Slurry – Per Ton, Measured.

#### 1.3 SUBMITTALS

- ##### A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

### PART 2 PRODUCTS

#### 2.1 MIX MATERIALS

- ##### A. Subsoil: Type S3 (Material Excavated from On-Site) as specified in Section 31 23 23 - Fill.

- B. Existing Subgrade.
- C. Existing Subbase or Base Material.
- D. Lime: Type B (Commercial Lime Slurry) in conformance with TxDOT Standard Specifications Item 260, “Lime Treatment (Road-Mixed).”

## 2.2 EQUIPMENT

- A. The pulverizing, mixing and proof rolling machinery, tools and equipment (capable of excavating subsoil, mixing and placing materials, wetting, consolidation, and compaction of materials), shall be on the project and approved by the City prior to the beginning of construction operations.
- B. All machinery, tools and equipment used shall be maintained in a satisfactory and workmanlike manner.
- C. If lime is furnished in trucks, each truck shall have the weight of lime certified on public scales or the Contractor shall place a set of standard platform truck scales or hopper scales at a location approved by the City.

## 2.3 LIME MIX

- A. Mix materials in accordance with TxDOT Standard Specifications Item 260, “Lime Treatment (Road-Mixed).”

# PART 3 EXECUTION

## 3.1 GENERAL

- A. The placement of lime shall not adversely impact vegetation, drainageways or waterways, storm water inlets or overflow channels. Structures shall be screened, blocked or protected to prevent lime from entering any structure or waterway.
- B. It is the primary requirement of this specification to secure a completed course of treated material containing a uniform lime mixture at the rate specified, free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his work, to use the proper amount of lime, maintain the work and rework the courses as necessary to meet the above requirements.
- C. The lime treated surface shall be constructed and shaped to conform to the typical sections, lines and grades as indicated or as established by the City. The material, either before or after lime is added, shall be excavated to the secondary grade (proposed) bottom of lime treatment and removed or windrowed to expose the secondary grade. For pavement construction, the secondary grade shall be blue topped at edge, 1/4 points and along the centerline at not more than 50 foot centers. Any wet or unstable materials below the secondary grade shall be corrected, as directed by the City, by removing the unstable material or by scarifying, adding lime and compacting until it is of uniform stability.

### 3.2 PREPARATION OF SURFACE

- A. The Contractor shall shape the subgrade or base, and proof roll. Any soft areas that this rolling may reveal will be corrected and proof rolled again until approved by the City.

### 3.3 PREMIXING SURFACE

- A. The surface shall be pulverized so that when all nonslaking aggregates retained on the No. 4 sieve are removed the remainder of the material shall meet the following requirements:
  - 1. Minimum passing 1 3/4 inch Sieve: 100 percent.
  - 2. Minimum passing No. 4 Sieve: 60 percent.
- B. Should the material uncovered during the premixing operation reveal properties which differ from the anticipated material, the City shall sample the material to establish a suitable rate of lime application.

### 3.4 LIME APPLICATION

- A. The application and mixing of lime with the material shall be accomplished by the methods hereinafter described. The minimum rate of lime solids applications shall be 5 percent by weight, unless otherwise indicated or as directed by the City.
  - 1. Slurry Placing: The lime shall be mixed with water in a mixer or trucks with approved distributors and applied as a slurry. Application shall be attained by successive passes over a measured section of roadway until the proper moisture and lime content has been secured. The distributor truck shall be equipped with an agitator which will keep the lime and water in uniform mixture.

### 3.5 MIXING

- A. The material and lime shall be thoroughly mixed by approved road pulverizer and the mixing continued until a homogeneous, friable mixture of material and lime is obtained, free from all clods or lumps so that when all nonslaking aggregates retained on the No. 4 sieve are removed the remainder of the material shall meet the following requirements:
  - 1. Minimum passing 1 3/4 inch sieve: 100 percent.
  - 2. Minimum passing No. 4 sieve: 60 percent.
- B. When treating subgrade material, use a cutting and pulverizing machine that will remove the subgrade material accurately to the secondary grade and pulverize the material at the same time. Contractor will not be required to expose the secondary grade nor windrow the material. For pavement construction, blue tops shall be set at edges, 1/4 points and along the centerline at not more than 50 foot centers. The machine shall be of such design that a visible indication is given at all times that the machine is cutting to the proper depth.
- C. During the interval of time between application and mixing, hydrated lime that has been exposed to the open air for a period of 6 hours or more or to excessive loss due to washing or blowing will not be accepted for payment and the area shall be retreated.

### 3.6 COMPACTION

- A. Compaction of the mixture shall begin immediately after mixing. The material shall be aerated or sprinkled as necessary to provide the optimum moisture. Compaction shall begin at the bottom and shall continue until the entire depth of mixture is uniformly compacted.
- B. The course shall be sprinkled as required and compacted to the extent necessary to provide the density specified below:
  - 1. Not less than 95 percent of the optimum density as determined by TxDOT Test Method Tex-121-E, Part II.
  - 2. Moisture content shall be within the range of 0 to 4 percentage points above the mixture's optimum moisture content.

### 3.7 FINISHING, CURING AND PREPARATION FOR SURFACING

- A. After the final layer or course of the lime treated subgrade, subbase, or base has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling with a pneumatic tire or other suitable roller sufficiently light to prevent hair cracking. The Contractor shall set blue tops at edges, 1/4 points and along the centerline at not more than 50 foot spacing. The completed section shall be moist cured for a minimum of 3 days before further courses are added or any through traffic is permitted, unless otherwise directed by the City. In cases where subgrade treatment or subbase sets up sufficiently to prevent objectionable damage from traffic, such layers may be opened to traffic 2 days after compaction. If the Drawings provide for the treated material to be sealed or covered by other courses of material, such seal or course shall be applied within 14 days after final mixing is completed, unless otherwise directed by the City.
- B. Top Surface of Subgrade: Plus or minus 0.50 inches from required elevations.

### 3.8 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. If the material fails to meet the testing requirements, it shall be reworked as necessary to meet these requirements. Throughout this entire operation the shape of the course shall be maintained by blading and the surface upon completion shall be smooth and in conformity with the typical section indicated and to the established lines and grades. Should the material, due to any reason or cause, lose the required stability, density and finish before the next course is placed, it shall be recompacted and refinished at the sole expense of the Contractor.
- C. Submit delivery tickets indicating actual materials delivered to Project site.

END OF SECTION

## DIVISION 32 – CIVIL SITE IMPROVEMENTS

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END OF SECTION

## SECTION 32 05 16 - AGGREGATES FOR CIVIL SITE IMPROVEMENTS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Coarse aggregate materials.
  - 2. Fine aggregate materials.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Aggregate:
  - 1. Basis of Measurement and Payment: Fine aggregate and coarse aggregate will not be paid for as a separate bid item, but shall be considered incidental to the item for which they pertain.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

#### 1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.

### PART 2 PRODUCTS

#### 2.1 COARSE AGGREGATE MATERIALS

- A. Coarse Aggregate Type A1 (Flexible Base): Conforming to TxDOT's Standard Specifications Item 247, Grade 1-2, Type A.
- B. Coarse Aggregate Type A2 (Crushed Stone): washed; free of shale, clay, friable material and debris; graded in accordance with ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; within the following limits, based on ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction:

Coarse Aggregate Type A2 Grading  
Grade No. 2

| Sieve Size   | Percent Passing |
|--------------|-----------------|
| 2 inches     | 100%            |
| 1-1/2 inches | 95-100%         |
| 3/4 inch     | 40-70%          |
| 3/8 inches   | 10-30%          |
| No. 4        | 0-5%            |



\*\*\*OR\*\*\*

Coarse Aggregate Type A2 Grading  
Grade No. 3

| Sieve Size   | Percent Passing |
|--------------|-----------------|
| 1-1/2 inches | 95-100%         |
| 3/4 inch     | 60-90%          |
| 1/2 inch     | 25-60%          |
| No. 4        | 0-5%            |

- C. Coarse Aggregate Type A3 (Gravel Base Course): Durable particles of gravel mixed with approved binding material; and shall be free from thin or elongated pieces, clay lumps, soil loam or vegetable matter. The material may be bank-run; or the binder may be added and incorporated by methods approved by City. Should the material be secured from pits, the overburden or stripping from the site of the pits shall be removed to such a distance that none shall fall or wash into the pit; and it shall be placed so as to divert surface drainage away from the pit site. The pit shall be well drained at all times. The pits shall be opened in such a manner as to expose the vertical faces of all strata of acceptable materials; and, unless otherwise directed by Owner, the materials shall be secured in successive vertical cuts extending through all the exposed strata, in order that a uniformity mixed material shall be secured.

1. Tests: Soil binder shall meet the following requirements:
  - a. Liquid limit shall not exceed 35 when tested in accordance with ASTM D4318-17 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  - b. Plastic limit shall be determined by testing in accordance with ASTM D4318-17.
  - c. Plasticity index shall not exceed 12 nor be less than 4 when calculated in accordance with ASTM D4318-17.
  - d. Prepare samples for testing according to ASTM D4318-17 and ASTM D2217 - Standard Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.
  - e. The linear shrinkage shall not exceed 6 percent.
2. Gradation: The material when tested by standard laboratory methods shall meet the following percentages by weight:

|                                 |           |
|---------------------------------|-----------|
| Passing 1 ¾ in. sieve (45.0 mm) | 100%      |
| Passing ¾ in. sieve (9.5 mm)    | 40 to 80% |
| Passing No. 4 sieve (4.75 mm)   | 25 to 60% |
| Passing No. 40 sieve (425 µm)   | 15 to 35% |

- a. Material passing the No. 40 sieve (425 µm) shall be known as “soil binder.”
- b. Materials containing conglomerate or gravel larger than 2” (50 mm) in any dimension shall be broken up and uniformly mixed with the remainder of the materials. Upgrading by the addition of washed gravel in order to meet the requirements of this section shall be permitted.

- c. If additional binder and/or soil binder are considered necessary by the Owner after gravel materials are spread and shaped, same shall be furnished and applied in the amount directed by the Owner; such additional binder and/or soil binder shall be carefully and evenly incorporated with the pit materials in place by scarifying, harrowing or other methods approved by the Owner.
  - 3. Rejection: Gravel which fails to meet the requirements of these specifications may be rejected by the City. Such rejection shall incur no cost to the Owner.
- D. Coarse Aggregate Type A4 (Gravel for Trench Backfill): Sandy gravel material, free of clay, shale, organic matter; meeting the following requirements:
  - 1. Tests:
    - a. The liquid limit shall not exceed 35 when tested in accordance with ASTM Designation D4318-17 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
    - b. The plasticity index shall not exceed 12 nor be less than 4 when calculated in accordance with ASTM Designation D4318-17.
    - c. The linear shrinkage shall not exceed six percent.
  - 2. Gradation: The material when tested by standard laboratory methods shall meet the following percentages by weight:

|                        |           |
|------------------------|-----------|
| Passing 2 in. sieve    | 100%      |
| Passing 1/2 inch sieve | 50 to 85% |
| Passing No. 4 sieve    | 20 to 65% |
| Passing No. 100 sieve  | 0 to 5%   |

## 2.2 FINE AGGREGATE MATERIALS

- A. Fine Aggregate Type A5 (Sand): Conforming to TxDOT's Standard Specifications Item 421.2.6.2, "Fine Aggregate."

## 2.3 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698.
- D. When tests indicate materials do not meet specified requirements, change material and retest.

## PART 3 EXECUTION

### 3.1 STOCKPILING

- A. Stockpile materials on site at locations designated by City.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

### 3.2 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

## SECTION 32 11 23 - FLEXIBLE BASE

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Crushed stone foundation course for structural backfill, embedment, trench backfill, surfacing, pavement or other base courses, furnished and installed on a prepared surface. The “Flexible Base” shall be constructed as herein specified in one or more courses in conformity with the typical sections and to the lines and grades as indicated or as established by the Engineer.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Flexible Base:
  - 1. Basis of Measurement: “Flexible Base” will be measured at depths specified for the area indicated, by the square yard or by the cubic yard, complete in place, as indicated in the bid.
  - 2. Basis of Payment: This item will be paid for at the contract unit price bid for “Flexible Base” which price shall be full compensation for all work herein specified, including the furnishing, hauling, placing and compacting of all materials, rolling, proof rolling, recompact and refinishing, for all water required and for all equipment, tools, labor and incidentals necessary to complete the work. Payment will be made under one of the following:
    - a. \_\_\_\_ - Inch Flexible Base (Method A) – Per Square Yard, Plan Quantity.
    - b. \_\_\_\_ - Inch Flexible Base (Method B) – Per Square Yard, Measured.
    - c. Flexible Base (Method A) – Per Cubic Yard, Plan Quantity.
    - d. Flexible Base (Method B) – Per Cubic Yard, Measured.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

#### 1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.

### PART 2 PRODUCTS

#### 2.1 FLEXIBLE BASE MATERIAL REQUIREMENTS

- A. Flexible Base: Texas Department of Transportation’s Standard Specification Item 247, Grade 1-2, Type A.

## 2.2 ACCESSORIES

- A. Herbicide: As specified in Section 31 10 00 - Clearing.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify compacted substrate is dry and ready to support paving and imposed loads.
  - 1. Proof roll substrate in accordance with Texas Department of Transportation Standard Specification Item 216, "Rolling (Proof)" to identify soft spots.
  - 2. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23 - Fill.
  - 3. No additional compensation will be made for materials, equipment or labor required for "Proof Rolling," but shall be considered subsidiary to "Flexible Base."
- C. Verify substrate has been inspected, gradients and elevations are correct.

### 3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

### 3.3 BASE PLACEMENT

- A. When specified in the Drawings, install geotextile fabric over subgrade in accordance with manufacturer's instructions.
  - 1. Lap ends and edges minimum 6 inches.
  - 2. Anchor fabric to subgrade when required to prevent displacement until aggregate is installed.
- B. When the Flexible Base compacted thickness is less than (or equal to) 6 inches, spread base material over prepared substrate to total compacted thickness indicated on Drawings.
- C. When the Flexible Base compacted thickness exceeds 6 inches, place base material equal thickness layers to total compacted thickness indicated on Drawings.
  - 1. Maximum Layer Compacted Thickness: 6 inches.
  - 2. Minimum Layer Compacted Thickness: 3 inches.
- D. Roller compact Flexible Base to density indicated in Texas Department of Transportation's Standard Specification Item 247.
- E. Level and contour surfaces to elevations, profiles, and gradients indicated.

- F. Maintain optimum moisture content of base materials to attain specified compaction density.
- G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

#### 3.4 TOLERANCES

- A. Texas Department of Transportation Item 247.2.1.1, "Tolerances."
- B. Maximum Variation from Flat Surface: 1/4 inch measured with 16-foot straight edge.
- C. Maximum Variation from Thickness: 1/2 inch.
- D. Maximum Variation from Elevation: 1/2 inch.

#### 3.5 COMPACTION

- A. Each course of flexible base shall be compacted to not less than 100 percent density when tested in accordance with TxDOT Test Method Tex-113-E. Field density determination shall be made in accordance with TxDOT Test Method Tex-115-E.

#### 3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. When tests indicate that Work does not meet specified requirements, remove Work, replace and retest.
- C. Submit delivery tickets indicating actual materials delivered to Project site.

END OF SECTION

## SECTION 32 11 24 – PORTLAND CEMENT TREATED BASE (PLANT MIXED)

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Portland Cement Treated Base (Plant Mixed).

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Portland Cement Treated Base Course:
  - 1. Basis of Measurement: By the square yard to elevations indicated on Drawings, complete in place, as indicated in the bid. No allowance shall be made for any materials used or work done outside of the limits established by Engineer.
  - 2. Basis of Payment: This item will be paid for at the contract unit price bid for “Portland Cement Treated Base,” which price shall be full compensation for supplying; handling; hauling and spreading base; spreading and shaping the base; compacting the base; including all rolling required for this compaction; surface finishing; curing; and for all manipulation, labor, equipment, appliances, tools and incidentals necessary to complete the work and carry out the maintenance provisions in this specification.
    - a. \_\_\_\_ - Inch Portland Cement Treated Base (Plant Mixed) – Per Square Yard, Plan Quantity.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

#### 1.4 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.

### PART 2 PRODUCTS

#### 2.1 AGGREGATE MATERIALS

- A. Coarse Aggregate: Type A3 (Gravel Base Course) as specified in Section 32 05 16 – Aggregates for Civil Site Improvements.

- 2.2 PORTLAND CEMENT: Type 1 as per ASTM C150 - Standard Specification for Portland Cement.
- 2.3 WATER: Potable, less than 250 ppm of chlorides.
- 2.4 MIX DESIGN: Prior to construction, the Contractor shall submit a proposed mix design for review and approval by the Engineer. The design data shall include type and amount of Portland cement; source, gradation, and amount of gravel; and compressive strength verification tests. Compressive strength shall be in the range of 500 to 1200 psi at 7 days.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify compacted substrate is dry and ready to support paving and imposed loads.
  - 1. Proof roll substrate to identify soft spots.
  - 2. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23 - Fill.
- C. Verify substrate has been inspected, gradients and elevations are correct.

### 3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

### 3.3 CEMENT TREATED BASE PLACEMENT

- A. Cement Plant Mixing: The gravel, base materials, cement, and water shall be thoroughly mixed in a stationary (pugmill) plant, either of the batch or continuous-flow type. The plant shall be equipped with feeding and metering devices which shall add the gravel, cement, and water into the mixer in the specified quantities.
  - 1. Gravel and cement shall be mixed sufficiently to prevent cement balls from forming when water is added.
  - 2. Mix until a uniform and homogeneous mixture of gravel, cement, and water is obtained. After mixing is completed, no additional water shall be added to the mixture unless otherwise approved by City.
  - 3. Haul mixture to construction site in suitable vehicles equipped with protective covers.
- B. Spread mixture over moistened, prepared subgrade in a uniform layer to a total compacted thickness as indicated on Drawings.
  - 1. Not more than 30 minutes shall elapse between the placement of cement treated base in adjacent lanes at any location except at longitudinal construction joints. Not more than 30 minutes shall elapse between the start of spreading the mixture and start of compaction. Not more than 60 minutes shall elapse between the start of mixing and the start of compaction of the cement treated base. The layer of cement treated base shall be



- uniform in thickness and surface contour; and in such quantity that the completed base shall conform to the required grade and cross section.
2. At the end of each days operation or at a lapse of more than two hours between loads, a full depth transverse header (butt-joint) shall be installed, so that proper compaction and performance can be attained. No longitudinal joints will be allowed.
- C. Roller compact base to 95 percent maximum density determined by ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>). Moisture content shall be within minus 2 to plus 2 percent of optimum.
- D. Roll surface with a pneumatic tire roller and “clipped,” “skinned,” and “tight-bladed” by a power grader to a depth of approximately ¼ inch, moving all loosened soil and cement from the section. The surface shall then be thoroughly compacted with the pneumatic roller, adding small increments of moisture as needed during rolling. When approved by City, surface finishing methods may be varied from this procedure, provided a dense, uniform surface, free of surface material, is maintained at its specified optimum during all finishing operations. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than two hours, a smooth, closely knit surface; free of cracks, ridges or loose material; conforming to the lines and grades shown on Drawings.
- E. Protection and Cover: Protect surface against rapid drying by applying two-tenths (0.2) gallon per square yard RC-2 cut-back asphalt. Immediately prior to application of RC-2, the section shall be wetted by the use of pressure water distributors so that all voids in the cement treated base surface are filled with water; but without free water standing on the surface. The RC-2 cure shall be applied while this moisture condition exists so that undue asphalt penetration of the surface shall be prevented. Cure finished course for at least 3 days. When a section is microcracked, cure section for an additional 2 days after microcracking.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- G. Microcracking: When indicated on the Drawings, perform work as directed in geotechnical report. When no geotechnical report exists, maintain finished course for a period of 24 to 48 hours. Roll the finished course with a vibratory roller to induce microcracking during this time, but not sooner than 24 hours. The vibratory roller shall have a static weight of equal to or more than 12 tons and the vibratory drum must be no less than 20 inches wide. The roller shall travel at a speed of 2 mph, vibrating at maximum amplitude, and make 2 to 4 passes with 100% coverage exclusive of the outside 1 ft. of the surface crown., unless otherwise directed by the City. Additional passes may be required to achieve the desired crack pattern. Notify the City 24 hr. before the microcracking occurs.
- H. Opening to Traffic: Heavy equipment shall not be permitted to drive over freshly completed portions. Pneumatic-tired equipment may be permitted after the surface has hardened sufficiently such that equipment will not mar the surface and provided that protection and cover are not impaired. The course may be opened to local traffic as soon as the RC-2 has been applied and dusted or sanded as necessary to prevent it being picked up by traffic. Completed portion may be opened to all traffic after meeting the provisions of E. above or after the minimum 500 psi compressive strength is obtained (Contractor required to obtain additional unconfined compression samples). Never less than 3 days of curing for reconstruction sections and 7 days for new location sections.

- I. HMAC Surface Courses: May be placed after seven days or after the minimum 500 psi compressive strength is obtained (Contractor required to obtain additional unconfined compression samples).

#### 3.4 TOLERANCES

- A. Maximum Variation from Flat Surface: 1/4 inch measured with 16-foot straight edge.
- B. Maximum Variation from Thickness: 1/2 inch.
- C. Maximum Variation from Elevation: 1/2 inch.

#### 3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. When tests indicate that work does not meet specified requirements, remove work, replace and retest.
- C. Submit delivery tickets indicating actual materials delivered to Project Site.

END OF SECTION

## SECTION 32 12 16 - HOT MIX ASPHALTIC CONCRETE PAVING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Asphalt materials.
  - 2. Aggregate materials.
  - 3. Asphalt paving surface course.
  - 4. Asphalt paving overlay for existing paving.

#### 1.2 UNIT PRICE MEASUREMENT AND PAYMENT PROCEDURES

- A. Basis of Measurement
  - 1. Method A: Asphaltic concrete pavement will be measured by the ton (2,000 pounds) of asphaltic concrete pavement of the type actually used in the completed and accepted work in accordance with the Drawings and specifications for the project. When the dryer-drum process is used, measurement of the tonnage used shall be made on truck scales.
  - 2. Method B: Asphaltic concrete pavement will be measured by the square yard of the specified total thickness of the type actually used in the completed and accepted work in accordance with the Drawings and specifications. Multiple lifts will be considered as one for square yard measurement purposes.
- B. Basis of Payment: The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit prices bid for "Hot Mix Asphaltic Concrete Pavement," of the types and lifts specified, which process shall be full compensation for furnishing all materials, freight involved; for all heating, mixing, hauling, cleaning the existing base course or pavement; saw cutting, placing asphaltic concrete mixture, rolling and finishing, for all manipulations, labor, tools, equipment, temporary pavement markings and incidentals necessary to complete the work. Correcting defective work and the subsequent retesting shall be considered subsidiary.

The prime coat will not be measured or paid for directly but shall be considered subsidiary to this Item, unless included as a separate pay item in the contract.

The tack coat will not be measured or paid for directly but shall be considered subsidiary to this Item, unless included as a separate pay item in the contract.

All templates, straightedges, scales and other weighing and measuring devices necessary for the proper construction, measuring and checking of the work shall be furnished, operated and maintained by the Contractor at his expense.

All saw cutting as shown on the Drawings or as directed by the City will not be measured or paid for directly, but shall be considered subsidiary to this Item.

Payment for work meeting the specifications will be made under one of the following:

- 1. Hot Mix Asphaltic Concrete Pavement, Type D Surface Course – Per Ton, Measured.

2. \_\_\_\_- Inch Hot Mix Asphaltic Concrete Pavement, Type D Surface Course – Per Square Yard, Plan Quantity.
3. Hot Mix Asphaltic Concrete Pavement, Type C Surface Course – Per Ton, Measured.
4. \_\_\_\_- Inch Hot Mix Asphaltic Concrete Pavement, Type C Surface Course – Per Square Yard, Plan Quantity.
5. Hot Mix Asphaltic Concrete Pavement, Type B – Per Ton, Measured.
6. \_\_\_\_- Inch Hot Mix Asphaltic Concrete Pavement, Type B – Per Square Yard, Plan Quantity.
7. Hot Mix Asphaltic Concrete Pavement, Type A – Per Ton, Measured.
8. \_\_\_\_- Inch Hot Mix Asphaltic Concrete Pavement, Type A – Per Square Yard, Plan Quantity.

### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

### 1.4 QUALITY ASSURANCE

- A. Mixing Plant: Conform to TxDOT's Standard Specifications for Construction of Highways, Streets and Bridges (latest Edition).
- B. Obtain materials from same source throughout.

### 1.5 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum 2 years documented experience as approved by City.

### 1.6 AMBIENT CONDITIONS

- A. Provide ambient conditions control facilities for product storage and installation.
- B. Do not place asphalt mixture when ambient air temperature is less than 50 degrees F and is falling (or surface is wet or frozen), but it may be placed when the air temperature is above 40 degrees F and is rising.
- C. Place asphalt mixture when temperature is not more than 30 degrees F less than initial mixing temperature.

## PART 2 PRODUCTS

### 2.1 ASPHALT PAVING

- A. Asphalt Materials:
  1. Asphalt Cement: Asphalt cement for the paving mixture shall meet the requirements of TxDOT Standard Specifications Item 300, "Asphalts, Oils, and Emulsions."
  2. Tack Coat: Asphaltic materials for tack coats, shown on the Drawings or approved by the City, shall meet the requirements of TxDOT Standard Specifications Item 300, "Asphalts, Oils, and Emulsions."

3. Additives: Additives to facilitate mixing and/or improve the quality of the asphaltic mixture shall be used when noted on the Drawings or may be used with the authorization of the City. The Contractor may choose to use either lime or a liquid anti-stripping agent to reduce the moisture susceptibility of the aggregate. The evaluation and addition of anti-stripping agents will be in accordance with TxDOT Standard Specifications Item 301, "Asphalt Anti-stripping Agents."

B. Aggregate Materials:

1. Coarse Aggregate: ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures; crushed stone or crushed gravel in accordance with TxDOT Standard Specifications Item 340.
2. Fine Aggregate: ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures; natural sand or sand manufactured from stone, gravel, or blast furnace slag in accordance with TxDOT Standard Specifications Item 340.
3. Mineral Filler: ASTM D242 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures; thoroughly dried stone dust or finely ground mineral particles, free of foreign matter; Portland cement, lime, or fly ash, in accordance with TxDOT Standard Specifications Item 340.

## 2.2 MIXES

- A. Asphalt Paving Mixture: Designed in accordance with TxDOT Standard Specifications Item 340 with a maximum 20 percent by weight reclaimed asphalt pavement.
- B. Submit proposed mix design with laboratory test reports supporting design for each type of mix specified in drawings for review and approval prior to beginning of work. Mix design shall be an approved TxDOT job mix formula from the local TxDOT District and date shall be no older than 12 months from current date and shall identify mix ingredients and proportions.
- C. Mixing Plant shall be certified for TxDOT work.
- D. Submit name of aggregate materials suppliers (TxDOT approved sources). Obtain materials from same source throughout.

## 2.3 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Test samples in accordance with TxDOT Standard Specifications Item 340.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.
- B. Verify compacted Flexible Base is dry and ready to support paving and imposed loads.

- C. Verify gradients and elevations of base are correct.
- D. Verify manhole frames and valve boxes are installed in correct position and elevation.

### 3.2 INSTALLATION

- A. Prime Coat:
  - 1. Apply prime coat in accordance with TxDOT Standard Specifications Item 340.
  - 2. Use clean sand to blot excess primer.
- B. Tack Coat:
  - 1. Apply tack coat in accordance with TxDOT Standard Specifications Item 340.
  - 2. Apply tack coat on asphalt and concrete surfaces and over Flexible Base surface at uniform rate.
    - a. New Surfaces: 0.10 gal/sq yd.
    - b. Existing Surfaces: 0.10 gal/sq yd.
  - 3. Apply tack coat to contact surfaces of curbs, gutters and structures.
  - 4. Coat surfaces of manhole and valve box frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.
- C. Single Course Asphalt Paving:
  - 1. Install Work in accordance with TxDOT Standard Specifications Item 340.
  - 2. Place asphalt within 24 hours of applying primer or tack coat.
  - 3. Place asphalt surface course to thickness indicated on Drawings.
  - 4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
  - 5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.
- D. Double Course Asphalt Paving:
  - 1. Place asphalt binder course within 24 hours of applying primer or tack coat.
  - 2. Place binder course to thickness indicated on Drawings.
  - 3. Place surface course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
  - 4. Place surface course to thickness indicated on Drawings.
  - 5. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
  - 6. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- E. Asphalt Paving Overlay
  - 1. Apply tack coat to existing paving surface at rate recommended by City.
  - 2. When indicated on the Drawings, install geotextile fabric in accordance with manufacturer's instructions to permit asphalt saturation of fabric. Lap fabric edge and end joints 4 inches.
  - 3. Place surface course to thickness indicated on Drawings.
  - 4. Compact overlay by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.

5. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

### 3.3 COMPACTION

- A. Compact the pavement uniformly to contain between 3.8% and 8.5% in-place air voids.

Furnish the type, size, and number of rollers required for compaction as approved. Use a pneumatic-tire roller to seal the surface unless excessive pickup of fines occurs. Use additional rollers as required to remove any roller marks. Use only water or an approved release agent on rollers, tamps, and other compaction equipment unless otherwise directed.

Use the control strip method shown in Tex-207-F, Part IV, on the first day of production to establish the rolling pattern that will produce the desired in-place air voids unless otherwise directed.

Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.

Complete all compaction operations before the pavement temperature drops below 160°F unless otherwise allowed. The Engineer may allow compaction with a light finish roller operated in static mode for pavement temperatures below 160°F.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. Sprinkle the finished mat with water or limewater, when directed, to expedite opening the roadway to traffic.

### 3.4 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge applied parallel with and at right angles to centerline of paved area.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation from Indicated Elevation: Within 1/4 inch.

### 3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Field quality control for Hot Mix Asphaltic Concrete (HMAC) Pavement shall be in accordance with TxDOT Designation: Tex-207-F – Determining Density of Compacted Bituminous Mixtures and TxDOT Standard Specifications Item 340, “Dense-Graded Hot Mix Asphalt.”
- C. Submit delivery tickets indicating actual materials delivered to Project site.

### 3.6 PROTECTION

- A. Immediately after placement, protect paving from mechanical injury until surface temperature is less than 140°F.

END OF SECTION



## SECTION 32 13 00 – CONCRETE CURB AND GUTTER

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Portland Cement concrete curb and gutter with reinforcing steel as required, constructed on an approved subgrade and base in accordance with this specification and in conformity with the lines, grades, section and details indicated on the Drawings.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

##### A. Concrete Curb and Gutter (Standard or Laydown):

1. Basis of Measurement: Accepted work as prescribed by this item will be measured by the linear foot of Concrete Curb and Gutter (Standard or Laydown), complete in place.
2. Basis of Payment: The work performed as prescribed by this item will be paid for at the unit price bid per linear foot for “Concrete Curb and Gutter (Standard or Laydown)”, which price shall be full compensation for all work as set forth and described under payment Method A or B.
  - a. Method A: This payment method includes all the work performed for “Concrete Curb and Gutter (Standard or Laydown)”, complete, at the unit price bid, which price shall be full compensation for excavation, preparing the subgrade, for furnishing and placing all base material, reinforcing steel, dowels, expansion joint material, curing material, backfilling and for all other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.
  - b. Method B: This payment method includes all the work performed for “Concrete Curb and Gutter (Standard or Laydown)”, complete, at the unit price bid, which price shall be full compensation for fine grading, for furnishing and placing reinforcing steel, dowels, expansion joint material, curing material, backfilling and for all other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.
  - c. Payment will be made under one of the following:
    - 1) Method A: Concrete Curb and Gutter – Per Linear Foot, Measured.
    - 2) Method A: Concrete Curb and Gutter – Per Linear Foot, Plan Quantity.
    - 3) Method B: Concrete Curb and Gutter – Per Linear Foot, Measured.
    - 4) Method B: Concrete Curb and Gutter – Per Linear Foot, Plan Quantity.

##### B. Ribbon Curb

1. Basis of Measurement: Per Linear Foot.
2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. Ribbon Curb – Per Linear Foot, Measured.
  - b. Ribbon Curb – Per Linear Foot, Plan Quantity.

##### C. Mountable Curb

1. Basis of Measurement: Per Linear Foot.
2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.

- a. Mountable Curb – Per Linear Foot, Measured.
- b. Mountable Curb – Per Linear Foot, Plan Quantity.

### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

## PART 2 PRODUCTS

### 2.1 CAST-IN-PLACE CONCRETE

- A. Concrete: Concrete shall conform to Class “A” Concrete as indicated in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements (or Class “P” as indicated in Section 32 13 13 – Concrete Paving when the curb is placed integral with the concrete pavement).
- B. Reinforcing Steel: Reinforcing steel shall conform to Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- C. Joint Materials:
  - 1. Premolded resilient joint filler for expansion joints shall conform to ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - 2. Joint sealer shall be in accordance with Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- D. Membrane Curing Compound: Membrane curing compound shall conform to ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, Type 2, Class B.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Subgrade for curb and gutter shall be excavated and prepared to required depth and width including a minimum of 12 inches behind the curb, unless a greater width is indicated, to construct the work to grades and dimensions indicated. A minimum of 4 inches of Flexible Base or Gravel Base Course shall be spread, wetted and thoroughly compacted under curb and gutter as specified in 32 11 23 – Flexible Base. If dry, the base shall be sprinkled with water lightly before concrete is deposited thereon.
- B. Forms shall be of metal or well seasoned wood. The length of the forms shall not be less than 10 feet. Flexible or curved forms shall be used for curves of 100 foot radius or less. Wood forms for straight sections shall be not less than 2 inches in thickness. Forms shall be clean, straight, free from warp and oiled with a light form oil. All forms shall be securely staked to line and grade and maintained in a true position during the depositing of concrete.
- C. The reinforcing steel (when specified) shall be placed in position as shown on the typical section. Care shall be exercised to keep all steel in its proper location.

- D. Expansion joint material,  $\frac{3}{4}$  inch in thickness, shall be provided at intervals not to exceed 40 feet and shall extend the full width and depth of the concrete. Weakened plane joints shall be made  $\frac{3}{4}$  inch deep at 10-foot intervals. All joint headers shall be braced perpendicular and at right angles to the curb.
- E. Two round smooth dowel bars, 5/8-inch diameter and 24 inches in length, shall be installed at each expansion joint. Fifteen inches of one end of each dowel shall be wrapped with 15-lb. felt paper so that it will not bond to the concrete. The dowels shall be installed with a dowel sleeve on the coated end as indicated or equivalent as directed by the Engineer.
- F. Concrete shall be placed in the forms, rodded and tamped to exclude all air and honeycomb. Not more than 1 hour after the concrete has been placed, a thin coating not more than  $\frac{1}{2}$  inch nor less than  $\frac{1}{4}$  inch thick of finish mortar, composed of 1 part Portland Cement to 2 parts fine aggregate, shall be worked into the exposed faces of the curb and gutter by means of a "mule". After the concrete has become sufficiently set, the exposed edges shall be rounded by the use of an edging tool to the radii indicated. The entire exposed surface of the curb and gutter shall be floated to a uniform smooth surface, then finished with a camel hair brush to a gritty texture. The forms shall remain in place a minimum of 24 hours unless approved otherwise by the Engineer. After removal of the forms, any minor honeycombed surfaces shall be plastered with a mortar mix as described above. Excessively honeycombed curb and gutter, as determined by the Engineer, shall be completely removed and replaced when directed.
- G. Immediately after finishing the curb, concrete shall be protected by a membrane curing compound.
- H. After a minimum of 3 days curing and before placing the final course base, the curb shall be backfilled to the full height of the concrete, tamped and sloped as indicated on the Drawings. The top 4 inches of backfill shall be of clean topsoil, free of stones and debris conforming to Section 31 05 13 – Topsoil.

### 3.2 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. When tests indicate that work does not meet specified requirements, remove work, replace and retest.

END OF SECTION

## SECTION 32 13 13 - CONCRETE PAVING

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Concrete paving for streets, roads, and alleys.

#### 1.2 UNIT PRICE MEASUREMENT AND PAYMENT

##### A. Concrete Paving:

1. Basis of Measurement: Per Square Yard or Square Foot.
2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. \_\_\_\_ - Inch Concrete Paving – Per Square Yard or Square Foot, Measured.
  - b. \_\_\_\_ - Inch Concrete Paving – Per Square Yard or Square Foot, Plan Quantity.

#### 1.3 SUBMITTALS

- ##### A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

#### 1.4 QUALITY ASSURANCE

- ##### A. Perform Work in accordance with ACI 301 - Specifications for Structural Concrete.
- ##### B. Conform to ACI 305 – Hot Weather Concreting, when concreting during hot weather, except as amended herein.
- ##### C. Conform to ACI 306.1 – Standard Specification for Cold Weather Concreting, when concreting during colder weather, except as amended herein.
- ##### D. Obtain cement and aggregate from same source throughout.
- ##### E. Batch Plant: Currently certified by the National Ready Mixed Concrete Association.
- ##### F. Mix Designer: Licensed professional engineer registered in the State of Texas or TxDOT approved mix designer.

#### 1.5 QUALIFICATIONS

- ##### A. Installer: Company specializing in performing work of this section with minimum three years documented experience.

#### 1.6 AMBIENT CONDITIONS

- ##### A. Provide ambient conditions control facilities for product storage and installation.

- B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- C. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days
- D. Joint Sealer: Maintain temperature and humidity recommended by sealant manufacturer during installation.

## 1.7 COORDINATION

- A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

## PART 2 PRODUCTS

### 2.1 CONCRETE PAVING

#### A. Form Materials:

- 1. Form Materials: shall be made of wood, metal, or other approved material and shall be like new to new condition.

#### B. Reinforcement:

- 1. Reinforcement Steel: All reinforcing bars to be deformed billet-steel, uncoated as follows:
  - a. Where welding is not required, ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement, Grade 60, deformed billet bars, uncoated finish.
  - b. Where reinforcing to be welded, ASTM A706/A706M – Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement, Grade 60.
- 2. Dowel Bars: Dowel bars shall be plain steel bars conforming to ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, or ASTM A966 – Standard Practice for Magnetic Particle Examination of Steel Forgings Using Alternating Current and shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the construction site each dowel bar shall be painted with one coat of paint conforming to MIL-DTL-24441/20A.SSPC Paint 5 or SSPC Paint 25. Metal or plastic collars (when indicated on Drawings) shall be full circular device supporting the dowel until the epoxy hardens.

The sleeves for dowel bars used in expansion joints shall be translucent of an approved design to cover 2 inches (minimum) of the dowel, with a closed end and with a suitable stop to hold the end of the bar at least 1½ inches from the closed end of the sleeve. Sleeves shall be of such design that they will not collapse during construction.

#### C. Concrete Materials:

- 1. Cement: ASTM C150 – Standard Specification for Portland Cement, Type I – Normal or Type III - High Early Strength.

2. Exposed Aggregate: Gravel washed natural mineral aggregate; furnished from single source.
  - a. Minimum Size: 1/4 inch.
  - b. Maximum Size: 1/2 inch.
  - c. Color: As selected.
3. Normal Weight Aggregates: ASTM C33 – Standard Specification for Concrete Aggregates furnished from a single source.
  - a. Meet ASTM C33 – Standard Specification for Concrete Aggregates.
  - b. Coarse Aggregate: Consisting of natural gravels, crushed gravels, crushed stone, or combination of these materials containing no more than 15% of flat, elongated particles (long dimension no more than 5 times short dimension). No more than 0.5% of coarse aggregate passing a 200 sieve.
  - c. Fine Aggregate: Clean, sharp natural sand with no more than 4% of fine aggregate passing a 200 sieve.
4. Water: potable, less than 250 ppm of chlorides.

## 2.2 ADMIXTURES

- A. General: Compatible with other admixtures and free from chlorides or other corrosive chemicals.
- B. Air Entrainment:
  1. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete, non-toxic after 30 days containing no chlorides.
  2. Concrete with air-entrainment admixture shall maintain air percentage, as batched, within plus or minus 2% for the time required for placement.
- C. High Range Water Reducing Admixture (Superplasticizer): ASTM C494/C494M – Standard Specification for Chemical Admixtures for Concrete.
  1. Hold slump of 5" or greater for time required for placement.
  2. Use Type F or Type G.
  3. Manufacturers
    - a. BASF Admixtures Inc.
    - b. Euclid Chemical Co.
    - c. WR Grace & Co.
- D. Water Reducing Admixture: ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete, Type A or Type D.
  1. Manufacturers:
    - a. BASF Admixtures Inc.
    - b. Euclid Chemical Co.
    - c. WR Grace & Co.
- E. Silica Fume: Not Allowed.
- F. Fly Ash: Type C or Type F

## 2.3 FABRICATION

- A. Form standard hooks for 180 degree bends and 90 degree bends as indicated on the Drawings.

## 2.4 MIXES

### A. Concrete Mix:

1. Mix and deliver concrete in accordance with ASTM C94 - Standard Specification for Chemical Admixtures for Concrete, Option a.
2. Select proportions for normal weight concrete in accordance with ACI 301 - Specifications for Structural Concrete, Method 1.
3. Concrete paving shall be Class "P" and shall conform to the following:

| <b>Class of Concrete</b> | <b>Design Strength at 28 days (psi)</b> | <b>Max. w/cm Ratio</b> | <b>Placement Slump Range, in.</b> | <b>General Usage</b>                 |
|--------------------------|-----------------------------------------|------------------------|-----------------------------------|--------------------------------------|
| P                        | 4,000                                   | 0.50                   | 4 to 5-1/2                        | Concrete pavement (including alleys) |

4. Submit Concrete Mix Design for each class of concrete (above table) from a batch plant that is currently certified by the National Ready Mixed Concrete Association. The Mix Designer shall be a licensed professional engineer registered in the State of Texas or a TxDOT approved Mix Designer. Concrete mix design date shall be no older than 12 months from current date (unless approval by City) from the local TxDOT District and shall identify mix ingredients and proportions, including admixtures.
5. Use accelerating admixtures in cold weather only when approved by the City in writing. Use of admixtures will not relax cold weather placement requirements.
6. Use calcium chloride only when approved by the City in writing.
7. Use set retarding admixtures during hot weather only when approved by the City in writing.

## 2.5 ACCESSORIES

- A. Curing Compound: ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, Type 2, Class B (white pigment).

### B. Joint Sealers:

1. Manufacturers:
  - a. Sonneborne Building Products.
2. Products Description:
  - a. General Purpose Traffic Bearing Sealant (Sealant self-leveling); Polyurethane; ASTM C920 – Standard Specification for Elastomeric Joint Sealants, Grade P, Class 25, Use T,M; single component.
    - 1) Type: Sonolastic SLI manufactured by Sonneborne.
    - 2) Color: Colors as selected.
    - 3) Applications: Use for exterior, pedestrian, and vehicular traffic bearing joints.

- C. Premolded Joint Filler: Premolded resilient joint filler for expansion joints shall conform to the requirements of ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types), and shall be punched to admit the dowels where called for on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the City. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to City. Joint filler shall be compatible with joint sealant.
- D. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- E. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- F. Bond Breaker
1. Manufacturers:
    - a. Burke Co.
    - b. Nox-Crete Products Group
    - c. Williams Distributors, Inc.
- G. Bonding Agent: Two component modified epoxy resin.
1. Manufacturers:
    - a. BASF Building Systems, Inc.
    - b. Euclid Chemical Co.
    - c. Sika Chemical Corp.
- H. Vapor Retarder: ASTM E1745 – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs Class A; 10 mil thick clear polyethylene film type recommended for below grade application. Furnish joint tape recommended by manufacturer.
- I. Non-Shrink Grout: ASTM C1107/C1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 24 hours and 7,000 psi in 7 days.
1. Manufacturers:
    - a. Euclid Chemical Company,
    - b. Master Builders
    - c. U.S. Grout Corp.
- J. Joint Backer Rod: Round foam rod compatible with sealant; ASTM D1056 – Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber, sponge or expanded rubber; D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.



## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify compacted base or subgrade is dry and ready to support paving and imposed loads.
  - 1. Proof roll subgrade with two perpendicular passes to identify soft spots.
  - 2. Remove soft subgrade or base and replace with Flexible Base.
- B. Verify gradients and elevations of underlying section are correct.
- C. Verify requirements for concrete cover over reinforcement.
- D. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

### 3.2 PREPARATION

- A. Moisten substrate to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole frames with oil to prevent bond with concrete paving.
- C. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.
- D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- E. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- F. Remove water from areas receiving concrete before concrete is placed.
- G. Joints:
  - 1. Locate expansion, control, contraction, and construction joints where shown.
  - 2. If not shown, provide construction joints at a maximum spacing of 40 feet.
  - 3. Vertical construction joints may not be greater than 20 feet from wall corners or intersections.
  - 4. Contraction joints shall be sawing immediately upon initial set of concrete and as practicable.

### 3.3 INSTALLATION

- A. Forms:
  - 1. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
  - 2. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- B. Reinforcement:
  - 1. Place reinforcing as indicated on Drawings.
  - 2. Interrupt reinforcing at expansion joints.

3. Provide doweled joints as indicated on Drawings. Dowel bars or other load-transfer units of an approved type shall be placed across joints in the manner as shown on Drawings. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment of by an approved assembly device to be left permanently in place. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. A dowel expansion cap or sleeve shall be furnished for each dowel bar used with expansion joints. These caps shall be substantial enough to prevent collapse and shall be placed on the ends of the dowels as shown on Drawings. The caps or sleeves shall fit the dowel bar tightly and the closed end shall be watertight. The portion of each dowel painted with rust preventative paint, as required under paragraph 2.1(B) and shown on Drawings to receive a debonding lubricant, shall be thoroughly coated with asphalt MC-70, or an approved lubricant, to prevent the concrete from bonding to that portion of the dowel. If free-sliding plastic-coated or epoxy-coated steel dowels are used, a lubrication bond breaker shall be used except when approved pullout tests indicate it is not necessary. Where butt-type joints with dowels are designated, the exposed end of the dowel shall be oiled.
4. Repair damaged galvanizing and/or epoxy coating to match shop finish.
5. Install tie bars consisting of deformed bars in joints as shown on Drawings. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on Drawings. They shall be held in position parallel to the pavement surface and in the middle of the slab depth. When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. These bars shall not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed in the female side of the keyed joint provided the installation is made without distorting the keyed dimensions or causing edge slump. If a bent tie bar installation is used, the tie bars shall be inserted through the keyway liner only on the female side of the joint. In no case shall a bent tie bar installation for male keyways be permitted.

C. Placing Concrete:

1. Ensure reinforcing, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
2. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
3. Place concrete in accordance with ACI 301 – Specifications for Structural Concrete and ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete, except as modified herein.
4. Notify testing laboratory and City minimum 24 hours prior to commencement of operations.
5. Discharge time: Not to exceed 90 minutes (from time batched at plant), unless otherwise approved by City.
6. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and reinforcement supports are not disturbed during concrete placement.
7. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs. Lap joints

minimum 6 inches and seal watertight by adhesive applied between overlapping edges and ends.

8. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
9. Separate slabs on grade from vertical surfaces with 2 inch thick joint filler.
10. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
11. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.
12. Install joint covers in longest practical length, when adjacent construction activity is complete.
13. Apply sealants in joint devices.
14. Deposit concrete at final position. Prevent segregation of mix.
15. Place concrete in continuous operation for each panel or section determined by predetermined joints.
16. Consolidate concrete.
17. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
18. Place concrete continuously between predetermined expansion, control, and construction joints.
19. Do not interrupt successive placement; do not permit cold joints to occur.
20. Place floor slabs in checkerboard or saw cut pattern.
21. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
22. Screed floors and slabs on grade level, maintaining surface flatness of a maximum of 1/8 inch in 10 feet.
23. Cold Weather:
  - a. Do not place when ambient temperature is below 40 degrees F.
  - b. Maintain surface temperature above 40 degrees F at all times.
  - c. Provide surface thermometers to monitor surface temperatures during curing.
  - d. Conform to ACI 306.1 – Standard Specification for Cold Weather Concreting and ACI 301 – Standard Specification for Structural Concrete requirements.
24. Hot Weather:
  - a. Prepare, mix, place, cure, and protect per ACI 305R – Guide to Hot Weather Concreting.
  - b. Maintain concrete temperature below 90 degrees F at all times.
  - c. Spray evaporation retardant on all exposed surfaces when temperature is greater than 90 degrees F.
  - d. Ensure that admixtures do not produce flash set plastic shrinkage or cracking from heat of hydration.

D. Joints: Joints shall be constructed as shown on Drawings and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on Drawings. Joints shall not vary more than 1/2-inch from their designated position and shall be true to line with not more than 1/4-inch variation in 10 feet. The surface across the joint shall be tested with a 10-foot straightedge as the joints are finished and any irregularities in excess of 1/4-inch shall be corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on Drawings.

1. Place expansion joints as indicated on Drawings. Premolded joint filler of the thickness as shown on Drawings shall extend for the full depth and width of the slab at the joint, except for space for sealant at the top of the slab. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface. A cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished. After the concrete has been placed and struck off, the cap shall be carefully withdrawn leaving the space for the premolded filler. The edges of the joint shall be finished and tooled while the concrete is still plastic. Any concrete bridging the joint space shall be removed for the full width and depth of the joint. Align curb, gutter, pavement, and sidewalk joints.
2. Place isolation joints between paving components and building or other structures as indicated on Drawings. Construct isolation joints identically to expansion joints as specified in (1), above. Isolation joints shall not be dowelled.
3. Provide construction joints as indicated on Drawings. Longitudinal construction joints shall be slip-formed or formed against side forms with or without keyways, as shown on Drawings. Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.
4. Install contraction joints at the locations and spacing as shown on Drawings. Contraction joints shall be installed to the dimensions required by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened. When the groove is formed in plastic concrete the sides of the grooves shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Groove or saw cut contraction joints ¼-inch wide at an optimum time as soon as possible after finishing. Cut ¼ of depth of slab into the slab. If contraction joint spacing is not indicated on Drawings, maximum contraction joint spacing shall be thirty (30) times the depth of the concrete paving.
5. Provide keyways as indicated on Drawings. Form keyways (only female keys permitted) in the plastic concrete by means of side forms or the use of keyway liners that are inserted during the slip-form operations. The keyway shall be formed to a tolerance of ¼ inch in any dimension and shall be of sufficient stiffness to support the upper keyway flange without distortion or slumping of the top of the flange. The dimensions of the keyway forms shall not vary more than plus or minus ¼ inch from the mid-depth of the pavement. Liners that remain in place permanently and become part of the keyed joint shall be made of galvanized, copper clad, or of similar rust-resistant material compatible with plastic and hardened concrete and shall not interfere with joint reservoir sawing and sealing.

E. Joint Sealant:

1. Examination:
  - a. Verify substrate surfaces and joint openings are ready to receive work.
  - b. Verify joint backer rod and release tapes are compatible with sealant.
2. Preparation:
  - a. Saw joints in accordance with Drawings.

- b. Immediately after sawing the joint, remove slurry and foreign matter from the joint and adjacent area by flushing with high-pressure water jet, and by use of other tools as necessary.
  - c. Immediately before sealing, clean and prime joints. Upon completion of cleaning, the joints shall be blown out with compressed air, free of oil and water. The joint faces shall be surface dry when the sealant is applied.
  - d. Perform preparation in accordance with ASTM C1193 - Standard Guide for Use of Joint Sealants.
  - e. Protect elements surrounding Work of this section from damage or disfiguration.
3. Installation:
- a. Perform installation in accordance with ASTM C1193 - Standard Guide for Use of Joint Sealants.
  - b. Apply joint sealant by means of pressure equipment that will force the sealing material to the bottom of the joint and completely fill the joint without spilling the material on the surface of the pavement. A backing material shall be placed as shown on Drawings and shall be nonreactive and nonadhesive to the concrete or the sealant material. Sealant that does not bond to the concrete surface of the joint walls, contains voids, or fails to set to a tack-free condition will be rejected and replaced by the Contractor at no additional cost. Before sealing the joints, the Contractor shall demonstrate that the equipment and procedures for preparing, mixing, and placing the sealant will produce a satisfactory joint seal. Any sealant spilled on the surface of the pavement, structures and/or adjacent areas shall be removed immediately.
  - c. Surface bond area on each side not less than 75 percent of joint width.
  - d. Install bond breaker where joint backing is not used.
  - e. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
  - f. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
  - g. Tool joints as detailed on Drawings.
  - h. Protect sealant until cured.

F. Finishing Schedule:

- 1. Vehicular Paving: Heavy broom
- 2. Sidewalk Paving: Medium broom
- 3. Concrete Driveways, fillets, valleys, and curb ramps: Heavy broom

G. Curing and Protection

- 1. Immediately after placement, protect concrete (by applying curing compound or use of curing blankets) from premature drying, excessively hot or cold temperatures, and mechanical injury.
- 2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

### 3.4 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- B. Maximum Variation from True Position: 1/4 inch.
- C. Maximum Variation in Thickness: 1/4 inch.

### 3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Inspect reinforcing placement for size, spacing, location, support.
- C. Testing firm will take cylinders and perform slump and air entrainment tests.
- D. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- E. Submit delivery tickets indicating actual materials delivered to Project site. Delivery tickets shall contain project description, date, time, class and quantity of mix, actual batch proportions, free moisture content of aggregate and quantity of water withheld.

### 3.6 PATCHING

- A. Allow City to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify City upon discovery.
- C. Inject leaking cracks with injection epoxy equal to Sikadur 55 SLV.
- D. Patch imperfections as directed by City.
- E. Provide a structurally sound surface finish, uniform in appearance acceptable to the City.
- F. Tie Holes:
  - 1. Fill with non-shrink grout.
  - 2. Match color of concrete.
  - 3. Compact using steel hammer or steel tool to high density.
  - 4. Cure with water.

### 3.7 PROTECTION

- A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit vehicular traffic over paving for 14 days (minimum) after finishing.

### 3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by City.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of City for each individual area.

D. Repair all concrete damaged by construction

END OF SECTION

## SECTION 32 30 00 - CAST-IN-PLACE CONCRETE FOR CIVIL SITE IMPROVEMENTS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section includes the requirements for all cast-in-place concrete, including:
  - 1. Concrete sidewalks
  - 2. Concrete driveways
  - 3. Concrete fillets
  - 4. Concrete valley gutters
  - 5. Concrete curb ramps
  - 6. Concrete flumes
  - 7. Concrete pilot channels
  - 8. Concrete riprap
  - 9. Concrete inlets
  - 10. Concrete headwalls
  - 11. Safety end treatment
  - 12. Concrete junction boxes, manholes, and manhole foundations
  - 13. Concrete thrust blocking, utility encasement, surface replacement, pipe bollards, manhole inverts, and manhole slabs
  - 14. Joint Sealer, pre-molded joint filler, and accessories

#### 1.2 UNIT PRICE MEASUREMENT AND PAYMENT

- A. Concrete Sidewalk:
  - 1. Basis of Measurement: Per Square Foot or Linear Foot (width shown on drawings).
  - 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
    - a. \_\_\_\_- Inch Thick Concrete Sidewalk – Per Square Foot or Linear Foot, Measured.
    - b. \_\_\_\_- Inch Thick Concrete Sidewalk – Per Square Foot or Linear Foot, Plan Quantity.
- B. Concrete Driveways (Type 1, Type 2 or Type 3):
  - 1. Basis of Measurement: Per Square Foot or Per Each.
  - 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
    - a. Concrete Driveway (Type 1)(Method A) – Per Square Foot, Measured.
    - b. Concrete Driveway (Type 1)(Method B) – Per Square Foot, Plan Quantity.
    - c. Concrete Driveway (Type 1)(Method C) – Per Each, Plan Quantity.
    - d. Concrete Driveway (Type 2)(Method A) – Per Square Foot, Measured.
    - e. Concrete Driveway (Type 2)(Method B) – Per Square Foot, Plan Quantity.
    - f. Concrete Driveway (Type 2)(Method C) – Per Each, Plan Quantity.
    - g. Concrete Driveway (Type 3)(Method A) – Per Square Foot, Measured.



- h. Concrete Driveway (Type 3)(Method B) – Per Square Foot, Plan Quantity.
- i. Concrete Driveway (Type 3)(Method C) – Per Each, Plan Quantity.

C. Concrete Fillet:

- 1. Basis of Measurement: Per Square Foot or Per Each.
- 2. Basis of Payment: Includes forms, reinforcing, concrete, integral curb, joints, accessories, placing, finishing, curing, and testing.
  - a. Concrete Fillet – Per Square Foot, Measured.
  - b. Concrete Fillet – Per Each, Plan Quantity.

D. Concrete Valley Gutter:

- 1. Basis of Measurement: Per Square Foot or Per Each.
- 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. Concrete Valley Gutter – Per Square Foot, Measured.
  - b. Concrete Valley Gutter – Per Each, Plan Quantity.

E. Curb Ramp:

- 1. Basis of Measurement: Per Each.
- 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. Curb ramp – Per Each, Measured.

F. Concrete Flume:

- 1. Basis of Measurement: Per Square Foot or Linear Foot (width shown on drawings.)
- 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. \_\_\_\_- Feet Wide Concrete Flume – Per Square Foot, Measured or Plan Quantity.
  - b. \_\_\_\_- Feet Wide Concrete Flume – Per Linear Foot, Measured or Plan Quantity.

G. Concrete Pilot Channel:

- 1. Basis of Measurement: By Square Foot or Linear Foot (width shown on drawings.)
- 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. \_\_\_\_- Feet Wide Concrete Pilot Channel – Per Square Foot, Measured or Plan Quantity.
  - b. \_\_\_\_- Feet Wide Concrete Pilot Channel – Per Linear Foot, Measured or Plan Quantity.

H. Inlets (Cast-In-Place):

- 1. Basis of Measurement: Per Each.
- 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. Curb Inlet Type CO-Recessed – Per Each, Measured.
  - b. Curb Inlet Type CO – Per Each, Measured.

- c. Drop Inlet – Per Each, Measured.
- d. Concave Gutter Inlet – Per Each, Measured.

I. Headwall (with or without Energy Dissipaters):

- 1. Basis of Measurement: Per Each.
- 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. Headwall – Per Each, Measured.
  - b. Headwall with Energy Dissipaters – Per Each, Measured.

J. Safety End Treatment (Cast-In-Place):

- 1. Basis of Measurement: Per Each.
- 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. Concrete Safety End Treatment – Per Each, Measured.

K. 10' x 10' Manhole Slabs:

- 1. Basis of Measurement: Per Each.
- 2. Basis of Payment: Includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. 10' x 10' Manhole Slab – Per Each, Measured.

L. Pipe Bollards:

- 1. Basis of Measurement: Per Each.
- 2. Basis of Payment: Includes forms, reinforcing, concrete, pipe, accessories, placing, finishing, curing, and testing.
  - a. Pipe Bollard – Per Each, Measured.

M. Concrete Riprap:

- 1. Basis of Measurement: By Square Foot or Square Yard.
- 2. Basis of Payment: includes forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, and testing.
  - a. Concrete Riprap – Per Square Foot or Square Yard, Measured or Plan Quantity.

N. Thrust Blocking, Pads, Utility Encasement, Surface Replacement, and Manhole Inverts:

- 1. Basis of Measurement and Payment: Shall be considered subsidiary to the construction item for which it pertains.

### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

### 1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

## 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 - Specifications for Structural Concrete.
- B. Conform to ACI 305 – Hot Weather Concreting, when concreting during hot weather, except as amended herein.
- C. Conform to ACI 306.1 – Standard Specification for Cold Weather Concreting, when concreting during colder weather, except as amended herein.
- D. Obtain cement and aggregate from same source throughout.
- E. Batch Plant: Currently certified by the National Ready Mixed Concrete Association
- F. Mix Designer: Licensed professional engineer registered in the State of Texas or TXDOT approved mix designer.

## 1.6 AMBIENT CONDITIONS

- A. Provide ambient conditions control facilities for product storage and installation.
- B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- C. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days
- D. Joint Sealer: Maintain temperature and humidity recommended by sealant manufacturer during installation.

## 1.7 COORDINATION

- A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

# PART 2 PRODUCTS

## 2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
  - 1. Use overlaid plywood complying with U.S Product Standard PS-1 “A-C or B-B High Density Overlaid Concrete Form”, Class I.

- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Cylindrical Columns and Supports: Form round-selection members with metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
- D. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

## 2.2 REINFORCING MATERIALS

- A. Materials shall be new, of domestic manufacture, and shall comply with the following material specifications.
- B. Reinforcing Steel: All reinforcing bars to be deformed billet-steel, uncoated as follows:
  - 1. Where welding is not required, ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement, Grade 60, deformed billet bars, uncoated finish.
  - 2. Where reinforcing to be welded, ASTM A706/A706M – Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement, Grade 60.
- C. Dowel Bars: Dowel bars shall be plain steel bars conforming to ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement, or ASTM A966 and shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the construction site each dowel bar shall be painted with one coat of paint conforming to MIL-DTL-24441/20A.SSPC Paint 5 or SSPC Paint 25. Metal or plastic collars (when indicated on Drawings) shall be full circular device supporting the dowel until the epoxy hardens.

The sleeves for dowel bars used in expansion joints shall be translucent of an approved design to cover 2 inches (minimum) of the dowel, with a closed end and with a suitable stop to hold the end of the bar at least 1½ inches from the closed end of the sleeve. Sleeves shall be of such design that they will not collapse during construction.

- D. Mechanical Splices and Connections:
  - 1. Metal Sleeve Splice: Furnish with cast iron filler metal capable of developing 125% of tensile bar strength. Manufacturer shall be Erico Products, Cadweld T-Series.
  - 2. Mechanical Threaded Connections: Furnish with metal coupling sleeve with internal threads engaging threaded ends of bars developing 125% of yield strength of bar. Manufacturer shall be Erico Products, Lenton Reinforcing Steel Couplers or Richmond Screw Anchor, Richmond DB-SAE Dowel Bar Splicers.
- E. Fabrication:

1. Form standard hooks for 180-degree bends and 90 degree bends as indicated on the Drawings.
- F. Reinforcing Accessory Materials:
1. Tie Wire: Minimum 16 gage black annealed type wire
  2. Chairs, Bolsters, Bar Supports, Spacers: CRSI Bar Support Specifications, Class 2 – Moderate Protection, stainless steel. Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.
  3. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather or Water Exposed Concrete Surfaces: CRSI Bar Support Specifications, Class 1 – Maximum Protection plastic tipped; size and shape to meet Project conditions.

## 2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150 – Standard Specification for Portland Cement, Type I – General Purpose; Type II – General Purpose Moderate with Sulfate Resistance; Type III - High Early Strength; Type V - Sulfate Resistant Portland type as specified.
1. Alkalies: Less than 60%.
- B. Normal Weight Aggregates: ASTM C33 – Standard Specification for Concrete Aggregates furnished from a single source.
1. Meet ASTM C33 – Standard Specification for Concrete Aggregates.
  2. Coarse Aggregate: In accordance with ACI 318 – Building Code Requirements for Structural Concrete consisting of natural gravels, crushed gravels, crushed stone, or combination of these materials containing no more than 15% of flat, elongated particles (long dimension no more than 5 times short dimension). No more than 0.5% of coarse aggregate passing a 200 sieve.
  3. Fine Aggregate: Clean, sharp natural sand per ASTM C33 - Standard Specification for Concrete Aggregates with no more than 4% of fine aggregate passing a 200 sieve.
- C. Exposed Aggregates: Gravel washed natural mineral aggregate; furnished from single source.
1. Minimum Size: 1/4 inch.
  2. Maximum Size: 1/2 inch.
  3. Color: As selected.
- D. Water: ACI 318 - Building Code Requirements for Structural Concrete; potable, less than 250 ppm of chlorides.

## 2.4 CONCRETE MIX DESIGN

- A. Design: Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301 – Specifications for Structural Concrete. If trial batch method used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Engineer.

1. Written reports: Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Engineer.

B. Concrete Mix:

1. Mix and deliver concrete in accordance with ASTM C94 - Standard Specification for Chemical Admixtures for Concrete, Option a.
2. Select proportions for normal weight concrete in accordance with ACI 301 - Specifications for Structural Concrete, Method 1.
3. Provide concrete to the following criteria:

| Class of Concrete | Design Strength at 28 days (psi) | Max. w/cm Ratio | Placement Slump Range, in. | General Usage                                                                                                                                                                                         |
|-------------------|----------------------------------|-----------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A                 | 3,000                            | 0.60            | As approved                | Curb, gutter, curb & gutter, sidewalks, driveways, fillets, valley gutters, pilot channels, flumes, riprap, safety end treatment, manhole slabs, surface replacement                                  |
| B                 | 2,000                            | 0.60            | As approved                | Small roadside sign anchors, utility encasements, thrust blocking                                                                                                                                     |
| C <sup>1</sup>    | 3,600                            | 0.45            | 4 to 5-1/2                 | Culverts (except top slab of direct traffic culverts), headwalls, wing walls, retaining walls, inlets, manholes, manholes bases or foundations, energy dissipaters, reinforced drilled shafts (piers) |
| P                 | 4,000                            | 0.50            | 4 to 5-1/2                 | Concrete pavement (including alleys)                                                                                                                                                                  |

<sup>1</sup> Structural Concrete Classes.

4. Submit Concrete Mix Design for each class of concrete (above table) from a batch plant that is currently certified by the National Ready Mixed Concrete Association. The Mix Designer shall be a licensed professional engineer registered in the State of Texas or a TxDOT approved Mix Designer. Concrete mix design date shall be no older than 12 months from current date (unless approval by City) from the local TxDOT District and shall identify mix ingredients and proportions, including admixtures.
5. Use accelerating admixtures in cold weather only when approved by the City. Use of admixtures will not relax cold weather placement requirements.
6. Use calcium chloride only when approved by the City in writing.
7. Use set retarding admixtures during hot weather only when approved by the City in writing.

## 2.5 ADMIXTURES

- A. General: Compatible with other admixtures and free from chlorides or other corrosive chemicals.
- B. Fly Ash (Pozzolan): Type C or Type F
- C. Air Entrainment:
  - 1. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete, non-toxic after 30 days containing no chlorides.
  - 2. Concrete with air-entrainment admixture shall maintain air percentage, as batched, within plus or minus 2% for the time required for placement.
- D. High Range Water Reducing Admixture (Superplasticizer): ASTM C494/C494M – Standard Specification for Chemical Admixtures for Concrete.
  - 1. Hold slump of 5" or greater for time required for placement.
  - 2. Use Type F or Type G.
  - 3. Manufacturers
    - a. BASF Admixtures Inc.; Rheobuild
    - b. Euclid Chemical Co.; Eucon 537
    - c. WR Grace & Co.; Daracem 100
- E. Water Reducing Admixture: ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete, Type A or Type D.
  - 1. Manufacturers:
    - a. BASF Admixtures Inc.; Pozzolith or Polyheed
    - b. Euclid Chemical Co.; Eucon WR-91
    - c. WR Grace & Co.; HYCOL
- F. Silica Fume: Not Allowed.

## 2.6 ACCESSORIES

- A. Curing Compound: ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, Type 2, Class B (white pigment).
- B. Joint Sealers:
  - 1. Manufacturers:
    - a. Sonneborne Building Products.
  - 2. Products Description:
    - a. General Purpose Traffic Bearing Sealant (Sealant self-leveling); Polyurethane; ASTM C920 – Standard Specification for Elastomeric Joint Sealants, Grade P, Class 25, Use T,M; single component.
      - 1) Type: Sonolastic SLI manufactured by Sonneborne.
      - 2) Color: Colors as selected.
      - 3) Applications: Use for exterior, pedestrian, and vehicular traffic bearing joints.
- C. Premolded Joint Filler: Premolded resilient joint filler for expansion joints shall conform to the requirements of ASTM D1751 – Standard Specification for Preformed Expansion Joint

Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types), and shall be punched to admit the dowels where called for on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the City. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to City. Joint filler shall be compatible with joint sealant.

- D. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- E. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- F. Bond Breaker:
  - 1. Manufacturers:
    - a. Burke Co.
    - b. Nox-Crete Products Group;
    - c. Williams Distributors, Inc.
- G. Bonding Agent: Two component modified epoxy resin.
  - 1. Manufacturers:
    - a. BASF Building Systems, Inc.
    - b. Euclid Chemical Co.
    - c. Sika Chemical Corp.
- H. Vapor Retarder: ASTM E1745 – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs Class A; **10 mil** thick clear polyethylene film type recommended for below grade application. Furnish joint tape recommended by manufacturer.
- I. Non-Shrink Grout: ASTM C1107/C1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of **4,000 psi** in 24 hours and **7,000 psi** in 7 days.
  - 1. Manufacturers:
    - a. Euclid Chemical Company,
    - b. Master Builders
    - c. U.S. Grout Corp.
- J. Joint Backer Rod: Round foam rod compatible with sealant; ASTM D1056 – Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber, sponge or expanded rubber; D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- K. Concrete Reinforcing Fibers: ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete, high strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete. Tensile strength -130 ksi; toughness, 15 ksi, 3/4 inch long fibers, 34 million/lb fiber count.
  - 1. Manufacturers:
    - a. W. R. Grace



- b. Fibermesh
- c. Forta
- d. ProMesh

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.
- B. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

### 3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- C. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- D. Remove water from areas receiving concrete before concrete is placed.
- E. Joints:
  - 1. Locate expansion, control, contraction, and construction joints where shown.
  - 2. If not shown, provide construction joints at a maximum spacing of 40 feet.
  - 3. Vertical construction joints may not be greater than 20 feet from wall corners or intersections.
  - 4. Contraction joints shall be sawing immediately upon initial set of concrete and as practicable.

### 3.3 FORM INSTALLATION

- A. Earth Forms:
  - 1. Trench earth forms are allowed only for below ground grade beams for concrete foundations.
  - 2. Trench earth forms neatly, accurately, and at least 2 inches wider than footing widths indicated on Drawings.
  - 3. Trim sides and bottom of earth forms.
  - 4. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
  - 5. Form sides of footings where earth sloughs.
  - 6. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.
- B. Formwork - General:

1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:

1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

D. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

E. Framing, Studding and Bracing:

1. Space studs at **16 inches** on center maximum for boards and **12 inches** on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of **2 inches** thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

F. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 318 – Building Code Requirements for Structural Concrete.

G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

H. Obtain Engineer's approval before framing openings in structural members not indicated on Drawings.

I. Install fillet and chamfer strips on external corners of all exposed surfaces of beams, walls, foundations, pump and housekeeping pads, and columns.

J. Install void forms in accordance with manufacturer's recommendations.

- K. Do not reuse wood forms for concrete surfaces to be exposed to view unless in a like “new” condition and approved by the Engineer. Do not patch formwork.
- L. Application – Form Release Agent
1. Apply form release agent on formwork in accordance with manufacturer's recommendations.
  2. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
  3. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
  4. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.
- M. Installation - inserts, embedded parts, and openings
1. Install formed openings for items to be embedded in or passing through concrete work.
  2. Locate and set in place items required to be cast directly into concrete.
  3. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
  4. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
  5. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.
  6. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
  7. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
  8. Form Ties:
    - a. Use sufficient strength and sufficient quantity to prevent spreading of forms.
    - b. Place ties at least **1 inch** away from finished surface of concrete.
    - c. Leave inner rods in concrete when forms are stripped.
    - d. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.
  9. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.
  10. Construction Joints:
    - a. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
    - b. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.

- c. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
  - d. Arrange joints in continuous line straight, true and sharp.
- 11. Embedded Items:
  - a. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
  - b. Do not embed wood or uncoated aluminum in concrete.
  - c. Obtain installation and setting information for embedded items furnished under other Specification sections.
  - d. Securely anchor embedded items in correct location and alignment prior to placing concrete.
  - e. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 – Building Code Requirements for Structural Concrete for size and location limitations.
- 12. Openings for Items Passing Through Concrete:
  - a. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
  - b. Coordinate work to avoid cutting and patching of concrete after placement.
  - c. Perform cutting and repairing of concrete required as result of failure to provide required openings.
- 13. Screeds:
  - a. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
  - b. Slope slabs to drain where required or as shown on Drawings.
  - c. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.
- 14. Screed Supports:
  - a. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
  - b. Staking through membrane is not permitted.
- 15. Cleanouts and Access Panels:
  - a. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
  - b. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

#### N. Form cleaning

- 1. Clean forms as erection proceeds, to remove foreign matter within forms.
- 2. Clean formed cavities of debris prior to placing concrete.
- 3. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

#### O. Form removal

1. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.
2. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
3. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
4. Leave forms in place for minimum number of days as specified in ACI 347.

### 3.4 REINFORCEMENT PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
  1. Do not weld crossing reinforcement bars for assembly except as permitted by Engineer.
- B. Do not displace or damage vapor retarder.
- C. Accommodate placement of formed openings.
- D. Install dowel embeds per manufacturer's requirements using an electric or pneumatic rotary drill with medium or light impact. Drills shall have an air flushing system.
- E. Do not field bend reinforcement unless approved by Engineer. Do not heat bars.
- F. Provide additional reinforcement around openings equivalent to one-half the cross-sectional area of the reinforcing steel interrupted by the opening.
- G. Lap splices shall be Class B tension lap splices per ACI 350 – Code Requirements for Environmental Engineering Concrete Structures.
- H. Use stainless steel chairs with stainless steel tips where exposed to weather or liquid. Use plastic tipped metal chairs in all other locations.
- I. Space reinforcement bars with minimum clear spacing in accordance with ACI 318 – Building Code Requirements for Structural Concrete of one bar diameter, but not less than 1 inch.
  1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.
- J. Maintain concrete cover around reinforcement in accordance with ACI 318 – Building Code Requirements for Structural Concrete as follows.
- K. Splice reinforcing where indicated on Drawings in accordance with splicing device manufacturer's instructions.

### 3.5 CONCRETE PLACEMENT

- A. Place concrete in accordance with ACI 301 – Specifications for Structural Concrete and ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete, except as modified herein.

- B. Notify testing laboratory and Engineer minimum 24 hours prior to commencement of operations.
- C. Discharge time: Not to exceed 90 minutes, unless otherwise approved by Engineer.
- D. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and reinforcement supports are not disturbed during concrete placement.
- E. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs. Lap joints minimum 6 inches and seal watertight by adhesive applied between overlapping edges and ends.
- F. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- G. Install construction joint devices in coordination with paving or slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- H. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.
- I. Install joint covers in longest practical length, when adjacent construction activity is complete.
- J. Apply sealants in joint devices.
- K. Deposit concrete at final position. Prevent segregation of mix.
- L. Consolidate concrete.
- M. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- N. Place concrete continuously between predetermined expansion, control, and construction joints.
- O. Do not interrupt successive placement; do not permit cold joints to occur.
- P. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- Q. Screed slabs-on-grade level, maintaining surface flatness of a maximum of 1/8 inch in 10 feet.
- R. Cold Weather:
  - 1. Do not place when ambient temperature is below 40 degrees F.
  - 2. Maintain surface temperature above 40 degrees F at all times.
  - 3. Provide surface thermometers to monitor surface temperatures during curing.

4. Conform to ACI 306.1 – Standard Specification for Cold Weather Concreting and ACI 301 – Specifications for Structural Concrete requirements.
- S. Hot Weather:
1. Prepare, mix, place, cure, and protect per ACI 305R – Guide to Hot Weather Concreting.
  2. Maintain concrete temperature below 90 degrees F at all times.
  3. Spray evaporation retardant on all exposed surfaces when temperature is greater than 90 degrees F.
  4. Ensure that admixtures do not produce flash set plastic shrinkage or cracking from heat of hydration.

### 3.6 CONCRETE FINISHING

- A. Rubbed Finish
1. The following areas shall require a rubbed finish and shall receive a first and second rubbing:
    - a. Vertical surfaces of piers, abutments, wingwalls, headwalls, and retaining walls which are exposed to view after backfill and embankment is placed.
    - b. Exposed formed surfaces of inlets.
  2. After removal of forms and as soon as the mortar used in pointing has set sufficiently, surfaces to be rubbed shall be wet with a brush and given a first surface rubbing with a medium coarse carborundum stone. This rubbing shall be done before the concrete has cured more than 48 hours.

The second rubbing shall present a cleaned uniform appearance free from drip marks and discoloration. It shall be given with a No. 30 carborundum stone or an abrasive of equal quality.

- B. Wood Float Finish
1. The following areas shall require a wood float finish:
    - a. Concrete pilot channels.
    - b. Concrete riprap.

- C. Broom Finish
1. The following areas shall require a broom finish:
    - a. Vehicular Paving: Heavy broom
    - b. Sidewalk Paving: Medium broom
    - c. Concrete Driveways, fillets, valley gutters, and curb ramps: Heavy broom

### 3.7 CONCRETE CURING

- A. Curing Concrete for Horizontal Surfaces
1. Cure concrete in accordance with ACI 308.1 – Standard Specification for Curing Concrete using one of the following methods.
    - a. Method 1: Protect the entire surface by submerging in water for a minimum of 7 days.

- b. Method 2: Cover with 1-inch layer of wet sand and keep continuously wet for a minimum of 7 days.
    - c. Method 3: Cover with burlap blanket or cotton mats and keep continuously wet for a minimum of 7 days.
    - d. Method 4: Continuously sprinkle the entire exposed surface for a minimum of 7 days.
  - 2. Membrane Curing: Unless otherwise indicated, either Type 1-D (Resin Base) or Type 2 membrane curing compound as per ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete and ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete may be used at the manufacturer's recommendation coverage application rate.
  - 3. Protect horizontal concrete surfaces during cold weather with plastic sheets or other approved materials.
  - 4. Use only water curing where additional finishes such as clear sealer, hardeners, painting, and special coatings are required.
- B. Curing Concrete for Vertical Surfaces
- 1. Cure concrete in accordance with ACI 308.1 - Standard Specification for Curing Concrete using one of the following methods.
    - a. Method 1: Leave concrete forms in place and keep entire surfaces of forms and concrete wet for a minimum of 7 days.
    - b. Method 2: Continuously sprinkle with water the entire exposed surface for a minimum of 7 days after removal of the forms.
    - c. Method 3: Apply curing compound in accordance with ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete and ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete, where allowed, immediately after removal of forms.
  - 2. General: Where vertical walls are to receive coatings, painting, cementitious material, or other similar finishes, use only water curing procedures.

### 3.8 PROTECTION OF FINISHED WORK

- A. Backfill: Do not backfill against walls for a minimum of 28 days after placement, unless otherwise approved by the Engineer. Place backfill uniformly across the wall.

### 3.9 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Field inspection and testing will be performed by Owner's testing laboratory in accordance with ACI 318 – Building Code Requirements for Structural Concrete.
- C. Provide free access to Work and cooperate with testing firm.
- D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.



- E. Concrete Inspections:
  - 1. Continuous Placement Inspection: Inspect for proper installation procedures.
  - 2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
- F. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.
- G. Submit delivery tickets indicating actual materials delivered to Project site. Delivery tickets shall contain project description, date, time, class and quantity of mix, actual batch proportions, free moisture content of aggregate and quantity of water withheld.

### 3.10 PATCHING

- A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.
- C. Inject leaking cracks with injection epoxy equal to Sikadur 55 SLV.
- D. Repair cracks as approved by the Engineer.
- E. Patch imperfections as directed by Engineer in accordance with ACI 318 – Building Code Requirements for Structural Concrete.
- F. Provide a structurally sound surface finish, uniform in appearance acceptable to the Engineer.
- G. Tie Holes:
  - 1. Fill with non-shrink grout.
  - 2. Match color of concrete.
  - 3. Compact using steel hammer or steel tool to high density.
  - 4. Cure with water.

### 3.11 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.
- D. Repair all concrete damaged by construction

END OF SECTION

## SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Fence framework, fabric, and accessories.
  - 2. Excavation for post bases.
  - 3. Concrete foundation for posts and center drop for gates.
  - 4. Manual gates and related hardware.
  - 5. Privacy slats.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Fencing:
  - 1. Basis of Measurement: By linear foot to fence height specified, based on specified post spacing.
  - 2. Basis of Payment: Includes posts, excavation, concrete, rails, tension wire, fabric, accessories, attachments.
    - a. Chain Link Fence ( \_\_\_\_ - Feet Height) – Per linear foot; measured.
    - b. Intruder Resistant Chain Link Fence ( \_\_\_\_ - Feet Height) – Per linear foot; measured.
- B. Gates:
  - 1. Basis of Measurement: Per each of the specified type and size.
  - 2. Basis of Payment: Includes frame posts, excavation, concrete, fabric, accessories, hardware.
    - a. \_\_\_\_ - Feet Tall Chain Link Gate ( \_\_\_\_ - Feet Width) – Per Each, Measured.
    - b. \_\_\_\_ - Feet Tall Intruder Resistant Chain Link Gate ( \_\_\_\_ - Feet Width) – Per Each, Measured.

#### 1.3 SYSTEM DESCRIPTION

- A. Fence Height: as indicated on Drawings.
- B. Line Post Spacing: At intervals not exceeding 10 feet.
- C. Fence Post and Rail Strength: Conform to ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework, Heavy Industrial Fence, quality.

#### 1.4 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

## 1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.
- B. Operation and Maintenance Data: Procedures for submittals.

## 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section.
- B. Installer: Company specializing in performing work of this section.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.
- B. Identify each package with manufacturer's name.
- C. Store fence fabric and accessories in secure and dry place.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers:
  - 1. Anchor Fence Inc.
  - 2. Cyclone Inc.
  - 3. Page Aluminized Steel Corp.

## 2.2 MATERIALS AND COMPONENTS

- A. Materials and Components: Conform to TxDOT's Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition), Item 550 – Chain Link Fence.
- B. Concrete: Type(s) specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.

# PART 3 EXECUTION

## 3.1 INSTALLATION

- A. Installation shall be in accordance with TxDOT's Standard Specifications for Construction of Highways, Streets, and Bridges (latest Edition), Item 550 – Chain Link Fence.

### 3.2 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From Indicated Position: 1 inch.
- C. Minimum distance from property line: 6 inches.

END OF SECTION

## SECTION 32 41 00 - PRECAST CONCRETE FOR CIVIL SITE IMPROVEMENTS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section includes structural precast concrete for:
  - 1. Precast Utility Structures, Manholes, Valve Vaults, and Meter Boxes.
  - 2. Connections and supporting devices.

#### 1.2 DESIGN REQUIREMENTS

- A. Precast Vaults shall comply with ASTM C858 – Standard Specification for Underground Precast Concrete Utility Structures, except as modified herein.
- B. Design live loads shall be in accordance with ASTM C857 – Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures. Design vaults to withstand site soil conditions and traffic loads of A-16 Table 1 of ASTM C857 with a 30% increase due to impact. Soil lateral loads shall be determined by ASTM C857.
- C. Maximum Allowable Deflection: 1/240 span.
- D. Design members exposed to weather to allow movement of components without damage, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to seasonal or cyclic day/night temperature ranges.
- E. Calculate structural properties of framing members in accordance with ACI 318 – Building Code Portal.
- F. Minimum vault thickness (wall and roof) shall be 6”.
- G. Construct walls to be water tight.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

#### 1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of PCI MNL-116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
- B. Maintain one copy of each document on site.

#### 1.5 QUALIFICATIONS

- A. Fabricator: Company specializing in performing Work of this section.
- B. Erector: Company specializing in erecting Work of this section.

- C. Design precast concrete members under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.
- D. Welder: Qualified within previous 12 months for types of welds indicated, in accordance with AWS D1.1 – Structural Welding Code – Steel and AWS D1.4 – Structural Welding Code – Reinforcing Steel.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle precast members in position consistent with their shape and design. Lift and support only from support points.
- B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.
- C. Protect members to prevent staining, chipping, or spalling of concrete.
- D. Mark each member with date of production and final position in structure.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Cement: Gray Portland, conforming to ASTM C150 Standard Specification for Portland Cement, Type III.
- B. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator, as appropriate to design requirements and PCI MNL-116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.

### 2.2 REINFORCEMENT

- A. Deformed Reinforcement: ASTM A615/A615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement Grade 60, steel bars.
- B. Welded Steel Wire Fabric: ASTM A185/A185M – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Plain Type in flat sheets

### 2.3 ACCESSORIES

- A. Connecting and Supporting Devices: 316 stainless steel Plates, angles, items cast into concrete or items connected to steel framing members, inserts, conforming to PCI MNL-123 – Design and Typical Details for Connections for Precast and Prestressed Concrete unfinished. Do not paint surfaces in contact with concrete or surfaces requiring field welding.
- B. Grout: Non-shrink Non-metallic minimum yield strength of 10,000 psi at 28 days
- C. Bearing Pads: High density plastic, 1/8 inch thick, smooth both sides, Tetrafluoroethylene (TFE)

- D. Bolts, Nuts and Washers: Type 304 stainless steel

## 2.4 FABRICATION

- A. Fabrication procedure to conform to PCI MNL-116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
- B. Maintain plant records and quality control program during production of precast members. Make records available upon request.
- C. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on shop drawings
- D. Tension reinforcement tendons as required to achieve design load criteria.
- E. Fabricate required openings with dimension larger than 8 inches and embed accessories provided by other Sections, at indicated locations.
- F. Exposed Ends at Stressing Tendons: Fill recess with non-shrink epoxy grout, trowel flush.
- G. Weld steel fabrications in accordance with AWS D1.1 – Structural Welding Code - Steel. Weld reinforcing steel in accordance with AWS D1.4 – Structural Welding Code – Reinforcing Steel. Do not tack weld reinforcing.

## 2.5 FINISHES

- A. Finish exposed-to-view finish surfaces of precast concrete members uniform in color and appearance.
- B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes including non-uniformity, staining, or surface cracking.
- C. Rubbed Finish: Surface holes or bubbles over 1/4 inch filled with matching cementitious paste, fins or protrusions removed and surface ground smooth, surface then rubbed with neat cementitious paste to smooth and even color and texture.

## 2.6 FABRICATION TOLERANCES

- A. Conform to PCI MNL-116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
- B. Maximum Variation from Intended Camber: 5/8 inch
- C. Maximum Out of Square: 1/8 inch/10 feet non-cumulative.
- D. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch

## 2.7 SOURCE QUALITY CONTROL AND TESTS

- A. Test and analyze stressing tendons in accordance with ASTM A416/A416M – Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
- B. Test and analyze concrete in accordance with PCI MNL-116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
- C. Take 3 concrete test cylinders for every 50 cu yds of concrete placed in accordance with ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- D. Take slump tests for every set of test cylinders in accordance with ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
- E. Take one air entrainment test for each set of exterior concrete test cylinders taken.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions are ready to receive work and field measurements are as indicated on shop drawings

### 3.2 PREPARATION

- A. Prepare support equipment for erection procedure, temporary bracing, and induced loads during erection.

### 3.3 ERECTION

- A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- B. Align and maintain uniform horizontal and vertical joints, as erection progresses.
- C. Maintain temporary bracing in place until final support is provided. Protect members from staining.
- D. Provide temporary lateral support to prevent bowing, twisting, or warping of members.
- E. Adjust differential camber between precast members to tolerance before final attachment.
- F. Install bearing pads.
- G. Level differential elevation of adjoining horizontal members with grout to maximum slope of 1: 12
- H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers.



- I. Grout underside of column and beam bearing plates and joints between members at roof, and floor locations.
- J. Weld reinforcing steel in accordance with AWS D1.4 – Structural Welding Code – Reinforcing Steel. Do not tack weld reinforcing.
- K. Secure units in place. Perform welding in accordance with AWS D1.1 – Structural Welding Code – Steel.

#### 3.4 FIELD QUALITY CONTROL

- A. Welding: Inspect welds in accordance with AWS D1.1 – Structural Welding Code - Steel.

#### 3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Protect members from damage caused by field welding or erection operations.
- B. Use non-combustible shields during welding operations to protect adjacent Work.

#### 3.6 CLEANING

- A. Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION

## SECTION 32 92 19 - SEEDING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Description: This item shall consist of preparing a seed bed to the lines and grades indicated, sowing of seed, fertilizing, mulching with straw, asphalt, cellulose fiber and other management practices along and across such areas as are indicated or as directed by the City.
- B. Section Includes:
  - 1. Fertilizing.
  - 2. Seeding.
  - 3. Hydroseeding.
  - 4. Mulching.
  - 5. Maintenance.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Seeding:
  - 1. Measurement: Work and acceptable material for "Broadcast Seeding" or "Hydraulic Seeding" will be measured by the square yard (Method A), by the acre (Method B), or by the linear foot (Method C), complete in place, with a minimum of 80 percent coverage with no bare areas exceeding 16 square feet and a 1 1/2 inch stand of grass. Bare areas shall be re-prepared and reseeded as required.
  - 2. Payment: The work performed and materials furnished and measured will be paid for at the unit price bid for "Broadcast Seeding" or "Hydraulic Seeding" of the method specified, which price shall be full compensation for furnishing all materials, including all topsoil (if not included as a separate pay item), water, seed, fertilizer, maintenance, mulch and for performing all operations necessary to complete the work. When paid by the linear foot, seeding will be for the width of ROW and/or width of easement (temporary construction and permanent). Payment will be made under one of the following:
    - a. Broadcast Seeding (Method A) – Per Square Yard, Measured.
    - b. Broadcast Seeding (Method B) – Per Acre, Plan Quantity.
    - c. Broadcast Seeding (Method C) – Per Linear Foot, Plan Quantity.
    - d. Broadcast Seeding (Method A)(including \_\_\_ - inch topsoil) – Per Square Yard, Measured.
    - e. Broadcast Seeding (Method B)(including \_\_\_ - inch topsoil) – Per Acre, Plan Quantity.
    - f. Broadcast Seeding (Method C)(including \_\_\_ - inch topsoil) – Per Linear Foot, Plan Quantity.
    - g. Hydraulic Seeding (Method A) – per Square Yard, Measured.
    - h. Hydraulic Seeding (Method B) – Per Acre, Plan Quantity.
    - i. Hydraulic Seeding (Method C) – Per Linear Foot, Plan Quantity.
    - j. Hydraulic Seeding (Method A)(including \_\_\_ - inch topsoil) – Per Square Yard, Measured.
    - k. Hydraulic Seeding (Method B)(including \_\_\_ - inch topsoil) – Per Acre, Plan Quantity.

- l. Hydraulic Seeding (Method C)(including \_\_\_ - inch topsoil) – Per Linear Foot, Plan Quantity.

### 1.3 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, Brome Grass, or vegetative species other than specified species to be established in given area.

### 1.4 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; and types, application frequency, and recommended coverage of fertilizer.

### 1.6 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

### 1.7 QUALIFICATIONS

- A. Seed Supplier: Company specializing in manufacturing Products specified in this section.
- B. Installer: Company specializing in performing work of this section.

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

### 1.9 MAINTENANCE SERVICE

- A. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition.

## PART 2 PRODUCTS

### 2.1 SEED

- A. All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing pure live seed (PLS), name and type of seed. Seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within nine months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers. A sample of each variety of seed shall be furnished for analysis and testing when directed by the City. The amount of seed planted per acre shall be of the type specified below.

### 2.2 ACCESSORIES

- A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable. Straw mulch shall be spread uniformly over the area indicated or as designated by the City at the rate of 2 to 2 1/2 tons of straw per acre. The actual rate of application will be designated by the City. Straw may be hand or machine placed and adequately secured.
- B. Cellulose Fiber Mulch: Cellulose fiber mulch shall be spread uniformly over the area indicated or as designated by the City at the rate of 45 to 80 lbs per 1000 square feet.
- C. Fertilizer: All fertilizer shall be delivered in bags or containers clearly labeled showing the analysis. The fertilizer is subject to testing by the State Chemist in accordance with the Texas Fertilizer Law. A pelleted or granulated fertilizer shall be used with an analysis indicated below. The figures in the analysis represent the percent of nitrogen, phosphoric acid and potash nutrients, respectively, as determined by the methods of the Association of Official Agricultural Chemists. Fifty percent or greater of the Nitrogen required shall be in the form of Nitrate Nitrogen (NO<sub>3</sub>). The remaining Nitrogen required may be in the form of Urea Nitrogen (CO(NH<sub>2</sub>)<sub>2</sub>).

In the event it is necessary to substitute a fertilizer of a different analysis, it shall be a pelleted or granulated fertilizer with a lower concentration. The total amount of nutrients furnished and applied per acre shall equal or exceed that specified for each nutrient.

Fertilizer shall be commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil to the following proportions: Nitrogen 15 percent, phosphoric acid 15 percent, soluble potash 15 percent.

- D. Lime: ASTM C602 – Standard Specification for Agricultural Liming Material, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.
- E. Water: Clean, fresh and free of industrial wastes and other substances or matter capable of inhibiting vigorous growth of grass.
- F. Soil Retention Blanket: Jute mesh or matting (open weave), or other material used as a soil retention blanket for erosion control purposes.
- G. Herbicide: As specified in Section 31 10 00 - Clearing.

H. Stakes: Softwood lumber, chisel pointed.

I. String: Inorganic fiber.

## 2.3 SOURCE QUALITY CONTROL

- A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.
- C. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.
- D. Submit tickets indicating actual materials delivered to Project site.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify prepared soil base is ready to receive the Work of this section.

### 3.2 PREPARING SEED BED

- A. After the designated areas have been rough graded to the lines, grades and typical sections indicated or as provided for in other items of this contract and any other soil area disturbed by the construction, a suitable seed bed shall be prepared. The seed bed shall consist of either 4 inches of approved topsoil or 4 inches of approved salvaged topsoil cultivated and rolled sufficiently to a state of good tilth which could prevent the seed from being covered too deep for optimum germination. The optimum depth for seeding shall be 1/4 inch. Water shall be applied as required to prepare the seed bed. Seeding shall be performed in accordance with the requirements hereinafter described.

### 3.3 FERTILIZING

- A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.
- B. Apply fertilizer at application rate as indicated below:

| Use               | Type          | Application Rate<br>Pound Per Acre |
|-------------------|---------------|------------------------------------|
| Broadcast Seeding | Any           | 400                                |
| Hydraulic Seeding | Water Soluble | 653                                |
| Sodding           | Any           | 300                                |

- C. Apply after smooth raking of topsoil and prior to roller compaction.
- D. Do not apply fertilizer at same time or with same machine used to apply seed.
- E. Mix fertilizer thoroughly into upper 2 inches of topsoil.
- F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

### 3.4 BROADCAST SEEDING

- A. The seed or seed mixture in the quantity specified shall be uniformly distributed over the prepared seed bed areas indicated or where directed. If the sowing of seed is by hand, rather than by mechanical methods, the seed shall be sown in two directions at right angles to each other. If mechanical equipment is used, all varieties of seed, as well as fertilizer, may be distributed at the same time, provided that each component is uniformly applied at the specified rate. After planting, the planted area shall be rolled with a corrugated roller of the "Culitpacker" type. All rolling of the slope areas shall be on the contour.
- B. Seed Mixture and Rate of Application for Broadcast Seeding: From September 15 to March 1, seeding shall be with a combination of unhulled Bermuda Grass at a rate of 2 pounds per 1000 square feet and winter rye at a rate of 7 pounds per 1000 square feet that has a PLS = 0.83. From March 1 to September 15, seeding shall be with hulled Bermuda Grass at a rate of 2 pounds per 1000 square feet with a PLS = 0.83. Fertilizer shall be applied as specified herein.
- C. Do not seed areas in excess of that which can be mulched on same day.
- D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.
- E. Lightly roll seeded area with roller not exceeding 112 lbs/linear foot.
- F. Immediately following seeding and rolling, apply mulch to thickness of 1/8 inch. Maintain clear of shrubs and trees.
- G. The broadcast seeded areas shall immediately be watered with a minimum of 5 gallons of water per square yard or as needed and in the manner and quantity as directed by the City. Water shall be applied at a minimum rate of 10 gallons per square yard weekly except when rainfall of 1/2 inch or greater occurs on the site, the water can be postponed for one week or as directed, until the grass is uniformly 1 1/2 inches in height.

### 3.5 HYDRAULIC SEEDING

- A. The seed bed shall be prepared as specified above and hydraulic seeding equipment, which is capable of placing all materials in a single operation, shall be used.

March 1 to September 15: Hydraulic seeding mixture and minimum rate of application per 1000 square feet:

| <b>Hulled Bermuda Seed (PLS = 0.83)</b> | <b>Water Soluble Fertilizer</b> | <b>Cellulose Fiber Mulch</b> | <b>Soil Tackifier</b> |
|-----------------------------------------|---------------------------------|------------------------------|-----------------------|
| 1 lb.                                   | 15 lbs.                         | 45.9 lbs.                    | 1.4 lbs.              |

September 15 to March 1: Add 7 pounds per 1000 square feet of winter rye with a PLS = 0.83 to above mixture. Fertilizer shall be applied as specified herein.

- B. Watering: Hydraulically planted seeded area shall be watered weekly, except when rainfall of 1/2 inch or greater occurs on the site, the watering can be postponed for one week, commencing after the tackifier has dried or until the grass is uniformly 1 1/2 inches in height.

The native grass seeded area shall be watered at a minimum rate of 5 gallons per square yard weekly commencing after the tackifier has dried or until the grass is uniformly 1 1/2 inches in height. The watering can be postponed for one week or as directed, when rainfall of 1 1/2 inches or greater occurs on the site.

### 3.6 SEED PROTECTION

- A. Cover seeded slopes where grade is 3:1 (Horizontal:Vertical) or greater with soil retention blanket. Roll fabric onto slopes without stretching or pulling.
- B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.
- C. Secure outside edges and overlaps at 36 inch intervals with stakes.
- D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

### 3.7 MAINTENANCE

- A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.
- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.
- D. Water to prevent grass and soil from drying out.
- E. Lightly roll surface to remove minor depressions or irregularities.
- F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

- G. Immediately reseed areas showing bare spots.
- H. Repair washouts or gullies.
- I. Protect seeded areas with warning signs during maintenance period.

END OF SECTION



## SECTION 32 92 23 - SODDING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Description: This item shall consist of providing fertilizer and planting Bermuda Grass or other acceptable sod indicated, along or across such areas as are indicated and in accordance with specification requirements outlined herein.
- B. Section Includes:
  - 1. Preparation of subsoil.
  - 2. Placing topsoil.
  - 3. Fertilizing.
  - 4. Sod installation.
  - 5. Maintenance.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Sodded Areas:
  - 1. Measurement: Work and acceptable material for "Sodding" will be measured by the square yard complete in place with a minimum of 95 percent growth with a 2 1/2 inch stand of grass.
  - 2. Payment: The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit price bid for "Bermuda Block Sodding" or "St. Augustine Block Sodding" as the case may be, which prices shall each be full compensation for completing the work including all topsoil (if not included as separate pay item), water, rolling, pegging, fertilizer, and maintenance as indicated. Payment will be made under one of the following:
    - a. Bermuda Block Sodding – Per Square Yard, Measured.
    - b. Bermuda Block Sodding – Per Square Yard, Plan Quantity.
    - c. Bermuda Block Sodding (including \_\_\_ - inch topsoil) – Per Square Yard, Plan Quantity.
    - d. St. Augustine Block Sodding – Per Square Yard, Measured.
    - e. St. Augustine Block Sodding – Per Square Yard, Plan Quantity.
    - f. St. Augustine Block Sodding (including \_\_\_ - inch topsoil) – Per Square Yard, Plan Quantity.

#### 1.3 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, Brome Grass or vegetative species other than specified species to be established in given area.

#### 1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit maintenance instructions, cutting method and maximum grass height; and types, application frequency, and recommended coverage of fertilizer.

## 1.6 QUALITY ASSURANCE

- A. Sod: Root development capable of supporting its own weight without tearing, when suspended vertically by holding upper two corners.

## 1.7 QUALIFICATIONS

- A. Sod Producer: Company specializing in manufacturing Products specified in this section.
- B. Installer: Company specializing in performing work of this section.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sod on pallets or in rolls as specified. Protect exposed roots from dehydration.
- B. Do not deliver more sod than can be laid within 24 hours.

## 1.9 COORDINATION

- A. Coordinate with installation of underground sprinkler system piping and watering heads.

## 1.10 MAINTENANCE SERVICE

- A. Maintain sodded areas immediately after placement until grass is well established and exhibits vigorous growing condition.

# PART 2 PRODUCTS

## 2.1 SOD

- A. Sod: The sod shall consist of live, growing Bermuda Grass or other acceptable sod indicated secured from sources where the soil is fertile. St. Augustine and Bermuda sod shall have a healthy, virile root system of dense, thickly matted roots throughout the soil of the sod for minimum thickness of 1 inch. The thickness measure does not include grass. The sod shall be cut in rectangular pieces with its shortest side not less than 12 inches. The Contractor shall not use sod from areas where the grass is thinned out nor where the grass roots have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted. The sod shall be free from noxious weeds or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. Unless the area has been closely pastured, it shall be closely mowed and raked to remove all weeds and long standing stems. Sources from which sod is to be secured shall be approved by the Engineer.

Care shall be taken at all times to retain the native soil of the roots of the sod during the

process of excavating, hauling and planting. Sod material shall be kept moist from the time it is dug until planted. When so directed by the Engineer, the sod existing at the source shall be watered to the extent required prior to excavating.

## 2.2 SOIL MATERIALS

- A. Topsoil: As specified in Section 31 05 13 – Topsoil.

## 2.3 ACCESSORIES

- A. Fertilizer: Commercial grade; recommended for grass, with fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil to the following proportions: nitrogen 15 percent, phosphoric acid 15 percent, soluble potash 15 percent.
- B. Lime: ASTM C602 – Standard Specification for Agricultural Liming Materials, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.
- C. Water: Clean, fresh and free of industrial wastes and other substances or matter capable of inhibiting vigorous growth of grass.
- D. Herbicide: As specified in Section 31 10 00 - Clearing.

## 2.4 SOURCE QUALITY CONTROL

- A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Provide recommendation for fertilizer and lime application rates for specified sod grass species as result of testing.
- C. Testing is not required when recent tests are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify prepared soil base is ready to receive the Work of this section.

## 3.2 PREPARATION OF SUBSOIL

- A. Prepare sub-soil and eliminate uneven areas and low spots.
- B. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

- C. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.
- D. Remove contaminated subsoil.
- E. Scarify sub-soil to depth of 4 inches where topsoil is to be placed.
- F. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

### 3.3 PLACING TOPSOIL

- A. Spread topsoil to minimum depth of 4 inches over area to be sodded.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas and to ensure positive drainage.
- E. Install edging at periphery of sodded areas in straight lines to consistent depth.

### 3.4 FERTILIZING

- A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.
- B. Apply fertilizer at application rate of 300 pounds per acre.
- C. Apply fertilizer after smooth raking of topsoil and prior to installation of sod.
- D. Apply fertilizer no more than 48 hours before laying sod.
- E. Mix fertilizer thoroughly into upper 4 inches of topsoil.
- F. Lightly water soil to aid dissipation of fertilizer.

### 3.5 LAYING SOD

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod immediately after delivery to site to prevent deterioration.
- C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.
- D. Lay smooth. Align with adjoining grass areas.
- E. Place top elevation of sod 1/2 inch below adjoining edging, paving, curbs, sidewalks or flatwork.

- F. On slopes 3:1 (Horizontal:Vertical) and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. When using “big roll”, lay sod parallel to slope. Drive pegs flush with soil portion of sod.
- G. Do not place sod when temperature is lower than 32 degrees F.
- H. Watering: Immediately after the area is sodded, it shall be watered with a minimum of 5 gallons of water per square yard or at 10 day intervals as needed and as directed by the Engineer. Water shall be applied a minimum rate of 3 gallons per square yard as required or as directed by the Engineer until final acceptance or until the grass uniformly reaches 2 1/2 inches in height.
- I. After sod and soil have dried, roll sodded areas to bond sod to soil and to remove minor depressions and irregularities.

### 3.6 MAINTENANCE

- A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing.
- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings after mowing and trimming.
- D. Water to prevent grass and soil from drying out.
- E. Roll surface to remove or irregularities.
- F. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.
- G. Immediately replace sod on areas showing deterioration or bare spots.
- H. Protect sodded areas with warning signs during maintenance period.

END OF SECTION

## DIVISION 33 - UTILITIES

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END OF SECTION

SECTION 33 01 30 – FRAMES, GRATES, RINGS AND COVERS AND MANHOLE GRADE  
ADJUSTMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Construction of frames, grates, rings and covers.
  - 2. Adjusting manhole frames and covers.
  - 3. Replacing manhole frames and covers.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Frames, Grates, Rings and Covers will not be measured and payment for furnishing all materials, tools, equipment, labor and incidentals necessary to complete the work will be included in the Bid items which constitute the complete structures.
- B. Adjusting Manhole Frames and Covers
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Includes removal, adjustment, and reinstalling manhole frame and cover, manhole rings, joint sealant, and incidentals.
- C. Replacing Manhole Frames and Covers
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Includes removal of old frame and cover, furnishing, installing new frame and cover, joint sealant, and incidentals.

1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section.
- B. Installer: Company specializing in performing work of this section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in undamaged, unopened container, bearing manufacturer's original labels. Inspect for damage.
- B. Protect materials from damage by storage in secure location.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

## PART 2 PRODUCTS

### 2.1 FRAMES, GRATES, RINGS AND COVERS

#### A. Manufacturers:

1. East Jordan Iron Works (EJ Group, Inc.).
2. Neenah Foundry (Neenah Enterprises, Inc.).

### 2.2 MATERIALS

#### A. Welded Steel:

1. Welded steel grates and frames shall conform to the member, size, dimensions and details indicated and shall be welded into an assembly in accordance with those details. Steel shall conform to the requirements of ASTM A36 - Standard Specification for Carbon Structural Steel.

#### B. Castings:

1. Castings, whether Carbon-Steel, Gray Cast Iron or Ductile Iron shall conform to the shape and dimensions indicated and shall be clean substantial castings, free from sand or blowholes or other defects. Surfaces of the castings shall be free from burnt on sand and shall be reasonably smooth. Runners, risers, fins and other cast on pieces shall be removed from the castings and such areas ground smooth. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact. Pairs of machined castings shall be matchmarked to facilitate subsequent identification at installation.
2. Steel castings shall conform to ASTM A27 - Standard Specification for Steel Castings, Carbon, for General Application. Grade 70-36 shall be furnished unless otherwise specified.
3. Cast iron castings shall conform to ASTM A48 - Standard Specification for Gray Iron Castings, Class 30.
4. Ductile Iron castings shall conform to ASTM A536 - Standard Specification for Ductile Iron Castings. Grade 60-40-18 shall be used unless otherwise indicated.

#### C. Rings:

1. ASTM A536 - Standard Specification for Ductile Iron Castings.

#### D. Nuts and Bolts:

1. Hot-dipped galvanized ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

#### E. Non-Shrink Grout:

1. Grout for bedding castings shall meet the requirements of Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.

#### F. Accessories:

1. Joint Sealant: ASTM C990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
2. Riser Rings.



## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify and locate manholes requiring grade adjustment.

### 3.2 CONSTRUCTION METHODS

- A. Frames, grates, rings and covers shall be constructed of the materials as specified and in accordance with the details indicated and shall be placed carefully to the lines or grades indicated or as directed by the City.
- B. All welding shall conform to the requirements of the AWS-D-1-72 – Structural Welding Code. Welded frames, grates, rings and covers shall be hot-dipped galvanized (ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength).
- C. Painting of gray iron castings will not be required, except when used in conjunction with structural steel shapes.

### 3.3 EXISTING WORK

- A. Saw cut existing paving, excavate, clean manholes, remove existing manhole frames and covers, and repair waterproofing.

### 3.4 ADJUSTING MANHOLE FRAMES AND COVERS

- A. Locate and raise manholes to grade as indicated on Drawings.
- B. Use precast concrete manhole rings to achieve elevation indicated for frame and cover.
- C. Do not adjust elevation more than 12 inches with manhole rings.
- D. Seal joints between manhole top, rings, and frame with sealant.
- E. Reinstall removed manhole frame and cover.

### 3.5 REPLACING MANHOLE FRAMES AND COVERS

- A. Remove existing manhole frames and covers to enable reuse and deliver to Owner.
- B. Install new frames and covers for manholes as indicated on Drawings. Adjust to match finished grade as indicated on Drawings. Seal joints between manholes and manhole frames.

### 3.6 PAVING RESTORATION

- A. Restore bituminous paving areas in accordance with Section 32 12 16 – Hot Mix Asphaltic Concrete Paving.
- B. Restore concrete paving areas in accordance with Section 32 13 13 – Concrete Paving.

END OF SECTION

## SECTION 33 05 14 - MANHOLES AND STRUCTURES

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Cast-in-Place concrete manholes and structures with transition to cover frame, covers, anchorage, and accessories.
2. Modular precast concrete manholes and structures with tongue-and-groove joints with transition to cover frame, covers, anchorage, and accessories.
3. Doghouse manhole connections to existing sanitary and storm sewer lines.
4. Bedding, embedment, and backfill materials.
5. Sewer manhole testing.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

##### A. Manholes and Structures:

1. Basis of Measurement: Per each.
2. Basis of Payment: Includes excavating, concrete foundation slab, concrete structure sections, concrete structure construction, cover frame and cover, to indicated depth, forming and sealing pipe inlets and outlets.
  - a. \_\_\_-Ft. Diameter Concrete Manhole (0'-5' Deep) with (Standard or Watertight) Cover - Per Each, Measured.
3. For manholes greater than five feet in depth, each additional foot above five feet shall be paid by the vertical foot.
  - a. Extra Depth for \_\_\_-Ft Diameter Manhole over 5-Ft. Deep – Per Vertical Foot, Plan Quantity.

##### B. Drop Fixtures:

1. Basis of Measurement: Per each.
2. Basis of Payment: Includes excavating, drop fixture to indicated depth, forming and sealing pipe inlets and outlets.
  - a. \_\_\_ - Inch External Drop Fixture – Per Each, Measured.
  - b. \_\_\_ - Inch Internal Drop Fixture – Per Each, Measured.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

#### 1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with precast concrete manufacturer's instructions and ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures, for unloading, storing and moving precast manholes and drainage structures.

- B. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.
- C. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: ACI 530 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

## PART 2 PRODUCTS

### 2.1 MANHOLES AND STRUCTURES

- A. Precast Concrete Manholes and Structures (Wastewater): Precast Reinforced Concrete Manhole sections shall be made from crushed limestone coarse aggregates and natural silica fine sand aggregates. The concrete shall be sulfate resistant concrete with Type V Portland Cement and antimicrobial admixture as per Paragraph 2.4(A). The maximum water-cement ratio shall be 0.40 and the 28-day concrete compressive strength shall not be less than 5000 psi and the absorption shall not exceed 9%. Fly ash may be used for up to 30% of the cementitious material provided it has been tested in accordance with ASTM C1012 - Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution, and exhibits a positive sulfate resistance when used with the sulfate-resistant concrete mix design. Type C fly ash shall not be used in sulfate resistant concrete. The structure shall be "moist-cured" for a minimum period of four (4) days.

The minimum wall thickness of the manhole shall be as follows:

| Manhole Size | Minimum Wall Thickness |
|--------------|------------------------|
| 48" I.D.     | 5"                     |
| 60" I.D.     | 6"                     |
| 72" I.D.     | 7"                     |
| 84" I.D.     | 8"                     |

Cone sections will be made with 5" minimum wall at the bottom and an 8" wall thickness at the top. All base riser sections will be made with the bottom cast monolithically. The minimum thickness of the bottom shall be 6" for all manhole diameters. The manhole diameter to be used shall be as indicated on Drawings.

- B. Precast Concrete Manholes and Structures (Stormwater): As specified in ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections and ASTM C858 – Standard Specification for Underground Precast Concrete Utility Structures.
- C. Cast-in-Place Manholes and Structures (Wastewater): Reinforced cast-in-place concrete as specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements with antimicrobial admixture per Paragraph 2.4(A).

- D. Cast-in-Place Manholes and Structures (Stormwater): Reinforced cast-in-place concrete as specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- E. Non-Shrink Grout: As specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- F. Reinforcement: As specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- G. Invert shall adhere to Texas Administrative Code (TAC), Chapter 217.

## 2.2 FRAMES, GRATES, RINGS AND COVERS

- A. Furnish and install in accordance with Section 33 01 30 – Frames, Grates, Rings, and Covers.

## 2.3 CONFIGURATION

- A. Shaft Construction and Concentric or Eccentric (as indicated) Cone Top Section: Reinforced precast or Cast-In-Place Concrete pipe sections, lipped male/female gasketed joints, sleeved to receive pipe.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: 48, 60, or 72-inch diameter as indicated on Drawings.
- D. Design Depth: As indicated on Drawings.
- E. Clear Cover Opening: 30 inches diameter.
- F. Pipe Entry: Furnish openings as indicated on Drawings.
- G. Structure Joint Gaskets: ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe; ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants; and Federal Specification No. SS-S-00210; rubber.
  - 1. Manufacturers:
    - a. Ram-Neck.
    - b. Kent-Seal No. 2.

## 2.4 ACCESSORIES

- A. Antimicrobial Admixture for Sulfate Resistant Concrete for Wastewater Manholes:
  - 1. An antimicrobial agent, ConShield®, or approved equal, shall be used to render the concrete uninhabitable for bacteria growth.
  - 2. The liquid antibacterial admixture shall be an EPA registered material and the registration number shall be submitted for approval prior to use in the project.
  - 3. The amount to be used shall be as recommended by the manufacturer of the antibacterial admixture. This amount shall be included in the total water content of the concrete mix design.

4. The admixture shall be added into the concrete mix water to insure even distribution of the admixture throughout the concrete mixture.
  5. ConTint concrete colorant, or approved equal, shall be added at the manufacturer's recommended dosage.
  6. Acceptance: acceptance of a product on the basis of a letter of certification to the Engineer stating that the correct amount and correct mixing procedure was followed for all antimicrobial concrete.
  7. Product Marking: add the name of the antimicrobial product.
- B. Concrete: Specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- C. Cement: ASTM C150 – Standard Specification for Portland Cement, Type V – sulfate resistant Portland type.
- D. Grout: Specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- E. Watertight Polyethylene: Heat-shrinkable manhole encapsulation system:
1. Manufacturers:
    - a. WrapidSeal by CCI Pipeline Systems.

## 2.5 FOUNDATION AND BACKFILL MATERIALS

- A. Foundation: Coarse Aggregate Type A2 (Grade No. 3) as specified in Section 32 05 16 – Aggregates for Civil Site Improvements.
- B. Backfill Materials:
1. Backfill Materials Outside of Traffic Areas: Excavated backfill material outside of traffic areas shall consist of an excavated material of gravel, fine rock cuttings, sandy loam, or clay having dimensions no greater than 2 inches.
  2. Backfill Materials Beneath Pavements:
    - a. Coarse Aggregate Type A1 (Flexible Base) per Section 32 11 23 – Flexible Base.
    - b. Aggregate Type A3 (Gravel for Trench Backfill) per Section 32 05 16 – Aggregates for Civil Site Improvements.
    - c. Flowable Fill per Section 31 23 24 – Flowable Fill.

## 2.6 VACUUM TESTING EQUIPMENT

- A. Vacuum pump.
- B. Vacuum line.
- C. Vacuum tester base with compression band seal and outlet port.
- D. Shut-off valve.
- E. Stop watch.
- F. Plugs.
- G. Vacuum gauge, calibrated to 0.1 inch Hg.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify items provided by other sections of Work are properly sized and located.
- C. Verify built-in items are in proper location, and ready for roughing into Work.
- D. Verify correct size of manhole and structure excavation.

### 3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe.
- B. Do not install manholes and structures where site conditions induce loads exceeding structural capacity of manholes or structures.
- C. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify manholes and structures are internally clean and free from damage. Remove and replace damaged units.

### 3.3 INSTALLATION - GENERAL

- A. Excavation:
  - 1. Excavate for manholes and structures in accordance with Section 31 23 16 - Excavation in location and to depth shown. Provide clearance around sidewalls of manhole or structure for construction operations.
  - 2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes or structures in dry trench.
  - 3. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation.
- B. Install manholes and structures supported at proper grade and alignment on Coarse Aggregate Type A2 (Crushed Stone) foundation as shown on Drawings. When indicated on Drawings, install geotextile fabric over subgrade in accordance with manufacturer's instructions.
- C. Backfill excavations for manholes and structures in accordance with Section 31 23 17 - Trenching.
- D. Form and place manhole or structure cylinder plumb and level, to correct dimensions and elevations.
- E. Grout base of manhole to construct invert and achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.
- F. Set cover frames and covers level without tipping, to correct elevations.

### 3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

- A. Lift precast manholes and structures at lifting points designated by manufacturer.
- B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and manhole or structure remains clean.
- C. Set precast manholes and structures bearing firmly and fully on Coarse Aggregate Type A2 (Crushed Stone), compacted in accordance with provisions of Section 31 23 23 - Fill. When indicated on Drawings, install geotextile fabric over subgrade in accordance with manufacturer's instructions.
- D. Assemble multi-section manholes and structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer's recommendations. Lower, set level, and firmly position base section before placing additional sections.
- E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.
- F. Joint sealing materials may be installed on site or at manufacturer's plant.
- G. Verify manholes and structures installed satisfy required alignment and grade.
- H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.
- I. Cut pipe to finish flush with interior of manhole or structure.
- J. Grout base of manhole to construct invert and achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.

### 3.5 CAST-IN-PLACE CONCRETE MANHOLE AND STRUCTURE INSTALLATION

- A. Prepare Coarse Aggregate Type A2 (Crushed Stone) bedding as shown on Drawings to receive foundation slab. When indicated on Drawings, install geotextile fabric over subgrade in accordance with manufacturer's instructions.
- B. Erect and brace forms against movement in accordance with Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- C. Install reinforcing steel as indicated on Drawings and in accordance with Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- D. Place and cure concrete in accordance with Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.

### 3.6 DOGHOUSE MANHOLE AND STRUCTURE INSTALLATION

- A. Stake out location and burial depth of existing sewer line in area of proposed manhole or structure.

- B. Carefully excavate around existing sewer line to adequate depth for foundation slab installation. Protect existing pipe from damage. Cut out soft spots and replace with select fill compacted to 95% dry density.
- C. Prepare crushed stone bedding as shown on Drawings.
- D. Install precast concrete or construct cast-in-place concrete manhole or structure around existing pipe in accordance with the appropriate paragraphs specified herein.
- E. Grout pipe entrances in accordance with Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- F. Perform connection to existing pipe at an appropriate time preapproved by Engineer.
- G. Block upstream flow at existing manhole or structure with expandable plug.
- H. Use hydraulic saw to cut existing pipe at manhole or structure entrance and exit and along pipe length at a point halfway up the outside diameter on each side of the pipe. Bottom half of pipe shall remain as manhole flow channel. Saw cut to have a smooth finish with top half of pipe flush with interior of manhole or structure.
- I. Grout base of manhole or structure to achieve slope to manhole or structure channel in accordance with Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements. Trowel smooth.

### 3.7 SANITARY MANHOLE DROP CONNECTIONS

- A. Construct drop connections into sanitary manholes in accordance with Drawings.
- B. Form channel from pipe drop to sweep into main channel at maximum angle of 30 degrees.

### 3.8 CASTINGS INSTALLATION

- A. Set frames using non-shrink grout as indicated on Drawings. Install precast concrete grade rings with 1/4 inch thick joints. Lay concrete rings in full bed of non-shrink grout and completely fill joints.
- B. Unless indicated otherwise, set frame and cover 8 inches above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning 2 inches below top surface of frame.

### 3.9 FIELD QUALITY CONTROL

- A. Test cast-in-place concrete in accordance with Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- B. Test concrete manhole and structure sections in accordance with ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
- C. Vertical Adjustment of Existing Manholes and Structures: Conform with Section 33 01 30 – Frames, Grates, Rings, and Covers.



1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated on Drawings.
4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete in accordance with Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.

### 3.10 SEWER MANHOLE TESTING

#### A. Examination:

1. Verify manholes are ready for testing.
2. Verify trenches are backfilled.
3. Verify pressure piping concrete reaction support blocking or mechanical restraint system is installed.

#### B. Testing Manholes:

1. General: Test using air whenever possible prior to backfilling to assist in locating leaks. Make joint repairs on both outside and inside of joint to ensure permanent seal. Test manholes with manhole frame set in place.
2. Vacuum test in accordance with ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill, and as follows:
  - a. Plug pipe openings; securely brace plugs and pipe.
  - b. Inflate compression band to effect seal between vacuum base and structure; connect vacuum pump to outlet port with valve open; draw vacuum to 10 inches of Hg; close valve; start test.
  - c. Test:
    - 1) Determine test duration for manhole from the following table:

| Manhole Diameter | Test Period |
|------------------|-------------|
| 4 feet           | 60 seconds  |
| 5 feet           | 75 seconds  |
| 6 feet           | 90 seconds  |

- 2) Record vacuum drop during test period; when vacuum drop is greater than 1 inch of Hg during test period, repair and retest manhole; when vacuum drop of 1 inch of Hg does not occur during test period, discontinue test and accept manhole.
- 3) When vacuum test fails to meet 1 inch Hg drop in specified time after repair, repair and retest manhole.

END OF SECTION

## SECTION 33 05 16 - UTILITY STRUCTURES

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section includes precast concrete utility structures:
  - 1. Drainage system catch basins.
  - 2. Drainage system inlets.
  - 3. Drainage system junction boxes.
  - 4. Drainage safety end treatments.
  - 5. Sanitary sewer lift station wet wells.
  - 6. Meter vaults (2-inch meters and larger)
  - 7. Valve vaults.
  - 8. Frames and covers.
  - 9. Access hatches.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Utility Structures:
  - 1. Basis of Measurement: Per each, of the type indicated or subsidiary to the bid item for which it pertains.
  - 2. Basis of Payment: Includes excavating, precast concrete structure, cover frame and cover, to design depth as indicated, forming and sealing pipe inlets and outlets, backfill and compaction.
    - a. Catch Basin – Per Each, Measured.
    - b. Inlet – Per Each, Measured.
    - c. Junction Box – Per Each, Measured.
    - d. Safety End Treatment – Per Each, Measured.
    - e. Lift Station Wet Well, Lift Station Valve Chamber, Meter Vault and Valve Vault structures shall be considered subsidiary to the bid item for which it pertains.

#### 1.3 DESIGN REQUIREMENTS

- A. Design structures for minimum loads in accordance with ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures, and ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Section Precast Concrete Water and Wastewater Structures.
  - 1. Roof Live Load: Comply with the following loading conditions, including impact load.
    - a. Traffic: AASHTO S99-HB - Standard Specifications for Highway Bridges; HS20-44, maximum 16,000 lb each wheel.
    - b. Non-traffic Areas: AASHTO S99-HB - Standard Specifications for Highway Bridges; HS10, maximum 8,000 lb each wheel.

#### 1.4 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

## 1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: As needed, accurately record actual locations and inverts of buried pipe, components, and connections.

## 1.6 QUALITY ASSURANCE

- A. Obtain precast concrete utility structures from single source.
- B. Perform Work in accordance with NPCA Quality Control Manual for Precast Plants.
- C. Conform to the following for material and fabrication requirements:
  - 1. Three Sided Structures: ASTM C1504 - Standard Specification for Manufacture of Precast Reinforced Concrete Three-Sided Structures for Culverts, Storm Drains, and Sewers.
  - 2. Other Structures: ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section.
- C. Design non-standard utility structures under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.
- D. Welders: AWS qualified within previous 12 months.

## 1.8 DELIVERY, STORAGE AND HANDLING

- A. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast structures. Lift structures from designated lifting points.
- B. Do not deliver products until concrete has cured 7 days or attained minimum 85 percent of specified 28 day compressive strength.
- C. Store precast concrete structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.
- D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

## PART 2 PRODUCTS

### 2.1 PRECAST CONCRETE UTILITY STRUCTURES

- A. Fabricators:
  - 1. Fortera.
  - 2. Oldcastle Precast, Inc.
  - 3. Capital Concrete Products.
  - 4. Tyler Products Sales, Inc.
- B. Precast Concrete Utility Structures: Reinforced precast concrete.
- C. Foundation Slab: Cast-in-place concrete of type specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements, leveled top surface.

### 2.2 CONCRETE MATERIALS

- A. Concrete:
  - 1. Cast-in-Place Concrete: Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
  - 2. Pre-Cast Structural Concrete: Section 32 41 00 – Precast Concrete for Civil Site Improvements

### 2.3 ADMIXTURES

- A. Manufacturers:
  - 1. Axim Italcementi Group, Inc.
  - 2. BASF Construction Chemicals.
  - 3. Cortec Corporation.
  - 4. Euclid Chemical Company.
  - 5. General Resource Technology.
  - 6. Grace Construction Products.
  - 7. Green Umbrella.
  - 8. Sika Corporation.
- B. Air Entrainment: ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
- C. Chemical Admixtures: ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
- D. Fly Ash: Not allowed.
- E. Blast Furnace Slag: Not allowed.

### 2.4 CONCRETE REINFORCEMENT

- A. Reinforcing Steel: ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, 60 ksi yield grade, deformed billet bars, uncoated finish.

## 2.5 FRAMES , GRATES, RINGS, AND COVERS

- A. Frames, grates, rings, and covers as specified in Section 33 01 30 – Frames, Grates, Rings, and Covers and as indicated on the Drawings.
- B. Manufacturers:
  - 1. Barry Pattern & Foundry Company.
  - 2. East Jordan Iron Works, Inc.
  - 3. McKinley Iron Works, Inc.
  - 4. Neenah Foundry Company.

## 2.6 ACCESS HATCHES

- A. Manufacturers:
  - 1. Halliday Products, Inc.
- B. Access Hatch: Aluminum welded construction, size as indicated; single or double door, as indicated.
  - 1. Cover: Diamond plate aluminum reinforced with structural stiffeners to support required loads.
  - 2. Frame: Angle type or channel type, as indicated; with integral seat to support cover stiffeners; anchor flange around frame perimeter.
  - 3. Hinges: Stainless steel.
  - 4. Lift Handle: Flush drop handle, non-removable type mounted in cover.
  - 5. Lifting Mechanism: Stainless steel compression springs with automatic hold open and dead stop to retain cover in open position. Cover springs to prevent contact by personnel entering utility structure.
  - 6. Latch Mechanism: Stainless steel lock with tamper-proof external handle and permanent internal release mechanism.
  - 7. Hardware: Stainless steel.

## 2.7 WALL SEAL ASSEMBLIES FOR PIPE PENETRATIONS

- A. Manufacturers:
  - 1. Link-Seal, Model “C” or “L” by GPT Industries, Inc.

## 2.8 ACCESSORIES

- A. Membrane Curing Compound: ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, Type 1-D clear or translucent, with fugitive dye or Type 2 white pigmented.
- B. Meter Box Frames and Covers:
  - 1. Cast Iron Castings: ASTM A48 - Standard Specification for Gray Iron Castings, Class 30 or better; free of bubbles, sand and air holes, and other imperfections.
  - 2. Ductile Iron Castings: ASTM A536 - Standard Specification for Ductile Iron Castings.
  - 3. Contact surfaces machined and matched.
  - 4. Cast cover inscription with pipeline service as indicated on Drawings.
- C. Steps: Formed galvanized steel rungs.

1. Diameter: 3/4 inch.
  2. Width: 12 inches.
  3. Spacing: 16 inches on center vertically or as indicated on Drawings.
- D. Inserted and Embedded Items:
1. Structural Steel Sections: ASTM A36 - Standard Specification for Carbon Structural Steel; hot-dipped galvanized.
- E. Joint Sealants and Joint Gaskets:
1. Gasket Joints for Circular Concrete Pipe: ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; standard rubber gaskets.
  2. External Sealing Bands: ASTM C877 - Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections; Type I rubber and mastic bands.
  3. Preformed Joint Sealants for Concrete Pipe and Box Sections: ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
  4. Elastomeric Joint Sealants: ASTM C920 - Standard Specification for Elastomeric Joint Sealants; polyurethane; Grade NS, Class 25; Sonolastic NPI manufactured by Sonneborn Building Products.
- F. Pipe Entry Connectors: ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
- G. Non-Shrink Grout: As specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- H. Bituminous Coating (where indicated):
1. Manufacturers:
    - a. Carboline Company, RPM International.
    - b. Duron, Inc.
    - c. Laurence, C.R. Co., Inc.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type I Inorganic.

## 2.9 CONCRETE MIX

- A. Select proportions for normal weight concrete in accordance with ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
- B. Provide concrete to the following criteria:
1. Compressive Strength: 4,000 psi at 28 days.
  2. Water Cement Ratio:
    - a. Concrete Exposed to Freezing and Thawing: Maximum 0.45 percent by mass.
    - b. Watertight Concrete Not Exposed to Freezing and Thawing: Maximum 0.45 percent by mass.
    - c. Concrete Exposed to Corrosive Conditions: 0.40 percent by mass.
  3. Air Content:

| Maximum Aggregate Size inches | Air Content, Percent |                   |
|-------------------------------|----------------------|-------------------|
|                               | Severe Exposure      | Moderate Exposure |
| 3/8 inches                    | 6.0 to 9.0           | 4.5 to 7.5        |
| 1/2 inches                    | 5.5 to 8.5           | 4.7 to 7.0        |
| 3/4 inches                    | 4.5 to 7.5           | 3.5 to 6.5        |
| 1 inches                      | 4.5 to 7.5           | 3.0 to 6.0        |
| 1-1/2 inches                  | 4.5 to 7.0           | 3.0 to 6.0        |

- C. Admixtures: Include admixture types and quantities indicated in concrete mix designs approved through submittal process.
1. Do not use calcium chloride.

## 2.10 BEDDING AND BACKFILL MATERIALS

- A. Embedment Material: As specified in Section 31 23 17 - Trenching.
- B. Backfill Materials: As specified in Section 31 23 17 - Trenching.

## 2.11 FABRICATION

- A. Fabricate precast reinforced concrete structures in accordance with ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures, to dimensions indicated on Drawings, and to specified design criteria.
- B. Fabricate precast concrete utility structures in accordance with NPCA Quality Control Manual for Precast Plants.
- C. Fabricate precast concrete utility structures to size, configuration, knock out panels, and openings as indicated on Drawings.
- D. Construct forms to provide uniform precast concrete units with consistent dimensions.
- E. Install reinforcing by tying or welding to form rigid assemblies. Position reinforcing to maintain minimum 1 1/2 inch cover. Secure reinforcement to prevent displacement when placing concrete.
- F. Position and secure embedded items to prevent displacement when placing concrete.
- G. Deposit concrete in forms. Consolidate concrete without segregating aggregate.
- H. Provide initial curing by retaining moisture using one of the following methods:
  1. Cover with polyethylene sheets.
  2. Cover with burlap or other absorptive material and keep continually moist.
  3. Apply curing compound in accordance with manufacturer's instructions.
- I. Provide final curing in accordance with manufacturer's standard.

- J. Remove forms without damaging concrete. Clean forms after each use.

## 2.12 CONCRETE FINISHES

- A. Formed Surfaces Not Exposed to View: As formed.
- B. Unformed Surfaces: Finish with vibrating screed or hand float.
  - 1. Permitted: Color variations, minor indentations, chips, and spalls.
  - 2. Not Permitted: Major imperfections, honeycomb, or other defects.
- C. Exposed to View Finishes: Troweled.

## 2.13 SOURCE QUALITY CONTROL

- A. Perform the following tests for each 150 cy of concrete placed, with minimum one set of tests each week.
  - 1. Slump: ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
  - 2. Compressive Strength: ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field and ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - 3. Air Content: ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method or ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
  - 4. Unit Weight: ASTM C138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- B. Visually inspect completed precast structures for defects.
  - 1. Repair defects affecting exposed to view surfaces to achieve uniform appearance.
  - 2. Repair honeycomb by removing loose material and applying grout to produce smooth surface flush with adjacent surface.
  - 3. Repair major defects only when permitted by City.
- C. Submit test results to City upon request.
- D. Allow witnessing of factory inspections and test at manufacturer's test facility. Notify City at least seven days before inspections and tests are scheduled.

## 2.14 FINISHING - STEEL

- A. Galvanizing: ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; hot dip galvanize after fabrication.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify items provided by other sections of Work are properly sized and located.



- C. Verify correct size and elevation of excavation.
- D. Verify subgrade and bedding is properly prepared, compacted and ready to receive Work of this section.

### 3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.
- B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- C. Inspect precast concrete structures immediately prior to placement in excavation to verify are internally clean and free from damage. Remove and replace damaged units.
- D. Ream pipe ends and remove burrs.
- E. Remove scale and dirt from components before assembly.
- F. Establish invert elevations for each component in system.
- G. Hand trim excavation to suit valve vaults and meter boxes. Remove stones, roots or other obstructions.

### 3.3 BEDDING AND BACKFILL

- A. Excavate in accordance with Section 31 23 16 - Excavation for work of this Section. Hand trim excavation for accurate placement of vaults and meter boxes to elevations indicated.
- B. Place bedding material level in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent Standard Proctor Density.
- C. Backfill around sides of vaults and meter boxes, tamped in place and compacted to 95 percent Standard Proctor Density.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.
- E. Install vaults and meter boxes and related components on bedding.
- F. Protect finished work.

### 3.4 INSTALLATION

- A. Install underground precast utility structures in accordance with ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
- B. Lift precast concrete structures at lifting points designated by manufacturer.
- C. When lowering structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.

- D. Install precast concrete base to elevation and alignment indicated on Drawings.
- E. Install precast concrete utility structures to elevation and alignment indicated on Drawings.
- F. Assemble multi-section structures by lowering each section into excavation.
  - 1. Clean joint surfaces.
  - 2. Install watertight joint seals in accordance with manufacturer's instructions using gasket joints, external sealing bands, preformed joint sealants, elastomeric joint sealants, grout, or as indicated on Drawings.
- G. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with grout.
- H. Connect pipe to structure and seal watertight. Cut pipe flush with interior of structure.
- I. Grout base to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage as indicated on Drawings.
- J. Set frame and cover and access hatch level without tipping, to elevations indicated on Drawings.
  - 1. Set cover and access hatch 6 inches above finished grade for structures located within unpaved areas to allow area to be graded away from cover beginning 2 inches below top surface of frame.
  - 2. Connect drain from access hatch frame to storm drainage system.
- K. Touch up damaged galvanized coatings.
- L. Backfill excavations for structures in accordance with Section 31 23 23 – Fill.

### 3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 – Quality Requirements.
- B. Perform vacuum test in accordance with Section 33 05 14 –Manholes and Structures.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

## SECTION 33 05 19 - PRESSURE PIPING TIED JOINT RESTRAINT SYSTEM

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Tied joint restraint system.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Tied Joint Restraint System:
  - 1. Basis of Measurement and Payment: Measurement and payment shall be considered incidental to Section 33 11 13 – Public Water Distribution Piping and Appurtenances or Section 33 31 13 – Public Sanitary Utility Sewerage Piping.

#### 1.3 DESIGN REQUIREMENTS

- A. Provide pressure pipeline with restrained joints at each bends, tees, and changes in direction.

#### 1.4 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements
- B. Project Record Documents: Record actual locations of joint restraints.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section.
- B. Fabricator: Company specializing in performing work of this section.
- C. Design tied joint restraint system under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.

#### 1.7 COORDINATION

- A. Coordinate work with installation of tied joint restraint systems with installation of fittings and joints that require restraint.

### PART 2 PRODUCTS

#### 2.1 TIED JOINT RESTRAINT SYSTEM

- A. Manufacturers:

1. Approved Manufacturer for DIP Push-on Joint Restraints:
  - a. EBAA Iron Sales, Inc.: Series 1700 “MEGALUG,” or equal.
  - b. Ford Meter Box Co., Inc.: Uni-Flange Series 1390.
2. Approved Manufacturer for PVC Push-on Joint Restraints:
  - a. EBAA Iron Sales, Inc.: Series 1900 for 4-inch through 12-inch pipe diameters and Series 2800 for 14-inch through 48-inch pipe diameters.
  - b. Ford Meter Box Co., Inc.: Uni-Flange Series 1390.

## 2.2 MATERIALS

- A. Steel Types:
  1. High Strength Low Alloy Weathering Steel, A242 (modified to meet AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings/A21.11), Core-Ten A.

## 2.3 COMPONENTS

- A. Tie Bolts: ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings/A21.11.
  1. 3/4 inch for 4 inch to 24 inch diameter mechanical joints; ASTM A242 - Standard Specification for High Strength Low Alloy Weathering Steel, high strength low alloy weathering steel, Core-Ten A (modified to meet AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings/A21.11), coated with a fluoropolymer coating.
  2. 1 inch for 30 inch diameter and larger mechanical joints, ASTM A242 - Standard Specification for High Strength Low Alloy Weathering Steel, high strength low alloy weathering steel, Core-Ten A (modified to meet AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings/A21.11), coated with a fluoropolymer coating.
- B. Tee-head Bolts: ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings /A21.11 and ASTM A242 - Standard Specification for High Strength Low Alloy Weathering Steel, high strength low alloy weathering steel, Core-Ten A (modified to meet ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings/A21.11) coated with fluoropolymer coating.
- C. Tie Nut: Hex nut for each tie bolt and tie rods.
  1. ASTM A242 - Standard Specification for High Strength Low Alloy Weathering Steel; coated with fluoropolymer coating.
- D. Tiepin: 3/4 inch round bar stock for use on bends and hydrants.
  1. 6 inch hairpin shape, ASTM A242 - Standard Specification for High Strength Low Alloy Weathering Steel; coated with fluoropolymer coating.
- E. Tie Coupling: Used to extend continuous threaded rods and provided with center stop to aid installation.
  1. ASTM A242 - Standard Specification for High Strength Low Alloy Weathering Steel; coated with fluoropolymer coating.
- F. Tie Clamp: Retainer clamp for ductile iron, and PVC, push-on pipe in front of bell.

1. ASTM A536 - Standard Specification for Ductile Iron Castings, 64-45-12 Ductile Iron.
- G. Tie Rod: Continuous threaded rod for cutting to desired lengths.
  1. ASTM A242 - Standard Specification for High Strength Low Alloy Weathering Steel; coated with fluoropolymer coating.
- H. Tie Bar: Steel bar used to restrain push-in plugs.
  1. ASTM A36 - Standard Specification for Carbon Structural Steel; galvanized.
- I. Tie Washer: Round flat washers.
  1. ASTM F436 - Specification for Hardened Steel Washers, Type 3; coated with fluoropolymer coating.
- J. Insulating Sleeves and Washers: One-piece integral sleeves and washers manufactured of high-density polyethylene, NEMA grade LE phenolic, or Mylar, by Advance Products and Systems, Inc., or equal.

## 2.4 FACTORY APPLIED FINISHES - STEEL

- A. Items to be zinc plated or galvanized to meet the following requirements:
  1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, for galvanizing iron and steel hardware.
  2. Galvanizing: ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; hot dip galvanize after fabrication.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify pipe and fittings are ready to receive work.
- C. Field measure and verify conditions.

### 3.2 PREPARATION

- A. Clean surfaces of pipe and fittings to receive tied joint restraint system.

### 3.3 INSTALLATION

- A. Install pipe and fittings in accordance with AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
- B. Install joint restraint system so joints are mechanically locked together to prevent joint separation.

### 3.4 ERECTION TOLERANCES

- A. Torque nuts on mating threaded fasteners to 45 foot pounds to 60 foot pounds for 5/8" nut.
- B. Torque nuts on mating threaded fasteners to 75 foot pounds to 90 foot pounds for 3/4" nut.
- C. Torque 1 inch nuts to 100 foot pounds to 120 foot pounds.

END OF SECTION

## SECTION 33 05 22 – BORING AND JACKING PIPE

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Excavation for approach trenches and pits.
  - 2. Casing pipe: Sleeve through which carrier pipe will be placed.
  - 3. Carrier pipe: Water or sewer pipe.
  - 4. Boring and Jacking: Method of installing casing pipe by cutting, or boring an opening in soils material, simultaneously forcing casing pipe through it with hydraulic jacks (Dry Bore).
  - 5. Casing Spacer: Fabricated item for positioning a carrier pipe inside a casing pipe.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Jacking or Boring Pipe:
  - 1. Basis of Measurement: Per Linear Foot measured along the central axis of jacked or bored pipe from face to face of jacked or bored pipe.
  - 2. Basis of Payment: Includes excavation, jacked or bored pipe, carrier pipe, grout, tests, backfill, labor, tools, equipment, and incidentals necessary to complete the Work.
    - a. Bore and Encase with \_\_\_- Inch Steel Casing Pipe – Per Linear Foot, Measured.

#### 1.3 DESIGN REQUIREMENTS

- A. Design casing pipe of leakproof construction. Design for earth and other pressures present plus highway H20 loading or railway E80 loading with associated recommended impact loading.
  - 1. Highway Crossings: Design tunnel for earth and other pressure loads present, plus highway AASHTO H20 live loading.
  - 2. Railroad Crossings: Design tunnel for earth and other pressure loads present, plus railroad E80 live loading with 50 percent added for impact.
- B. Design bracing, backstops, and use jacks of sufficient rating for continuous jacking without stoppage, except for adding pipe sections and as conditions permit, to minimize tendency of ground material to "freeze" around casing pipe.
- C. Design steel tunnel lining in accordance with AREMA Manual for Railway Engineering, Section 4.15.5.

#### 1.4 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of casing or tunnel liner, carrier pipe, and invert elevations.

- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### 1.6 QUALITY ASSURANCE

- A. When boring, jacking or tunneling under State highways, make application for and obtain permit.
- B. Perform Work in accordance TxDOT's Standard Specifications for Construction of Highways, Streets and Bridges (latest Edition).
- C. Additional criteria for work under railroads:
  - 1. Do not schedule work within and adjacent to Railroad property until City and Railroad approve submittals, including proper Railroad insurance.
    - a. Approval does not relieve Contractor of responsibility for adequacy and safety of procedures.
  - 2. Give Railroad advance written notice as described in permit, copied to City, before entering and working on Railroad property.
  - 3. Place in effect before work proceeds safety, precautionary, and protective devices and services required by Railroad.
  - 4. Follow AREMA or other applicable railroad specification and permit requirements.

#### 1.7 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum 5 years documented experience.
  - 1. Work Experience: Include projects of similar magnitude and conditions.
  - 2. Furnish list of references upon request.
- B. Design pipe jacking installation and load bearing falsework under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Texas.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Protect piping systems from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.
- C. Accept system components on site in manufacturer's original containers or configuration. Inspect for damage.
- D. Use wooden shipping braces between layers of stacked pipe. Stack piping lengths no more than 3 layers high.
- E. Store field joint materials indoors in dry area in original shipping containers. Maintain storage temperature of 60 to 85 degrees F.
- F. Support casing and carrier pipes with nylon slings during handling.



## 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Conduct operations so as not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

## 1.10 FIELD MEASUREMENTS

- A. Verify invert elevations of existing work prior to excavation and installation of casing tunnel.

## PART 2 PRODUCTS

### 2.1 CASING AND JACKING PIPE MATERIALS

- A. Steel Casing Pipe: ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless, 42,000 psi minimum yield strength, as indicated on Drawings (minimum wall thickness of 0.375 inch), full circumference welded joints in accordance with AWS D1.1 - Structural Welding Code – Steel, to withstand excavation forces.

### 2.2 CARRIER PIPE MATERIALS

- A. Water Distribution System Piping and Appurtenances: As specified in Section 33 11 13 – Public Water Utility Distribution Piping and Appurtenances.
- B. Sanitary Sewage System Piping: As specified in Section 33 31 13 – Public Sanitary Utility Sewerage Piping.
- C. Storm Drainage Piping: As specified in Section 33 41 13 – Public Storm Utility Drainage Piping and Culverts.

### 2.3 GROUT AND COVER MATERIALS

- A. Backfill for Trench Approaches and Pits to Finish Grade: As specified in Section 31 23 17 - Trenching.
- B. Grout: Grout voids between casing and existing ground. Grout shall consist of 1 part Standard Portland Cement and 4 parts of fine, clean sand mixed with water to produce a homogeneous, workable mixture.
- C. Pressure Grout Mix: One part Portland cement, and 6 parts mortar sand mixed with water to consistency applicable for pressure grouting.
- D. Mortar Sand: ASTM C404 - Standard Specification for Aggregates for Masonry Grout, Size No. 1.
- E. Portland Cement: ASTM C150 - Standard Specification for Portland Cement, Type I or Type II.

## 2.4 CASING SPACERS

- A. Fusion bond assembled carbon steel bands, risers, and studs with PVC or Epoxy 14 to 20 mils thick.
- B. Treat and coat stainless steel metal surfaces and welds in order to reduce chemical reactivity of its surface.
- C. Bands and Risers.
  - 1. Minimum 2 pieces, stainless steel plate: ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar, Type 304.
  - 2. Band: Minimum thickness: 14 gage for carrier pipes up to 12 inches diameter and 12 gage for pipes greater than 12 inches in diameter.
- D. Runners.
  - 1. High density molecular polyethylene or polymer reinforced fiberglass with DURO Hardness A of 80 and minimum dielectric strength of 500 volts per mil with sufficient compressive and shear strengths.
  - 2. Attach to risers with bolts or welded studs.
  - 3. Fill bolt holes with silicone caulk.
- E. Spacer Band: Line with minimum 0.090 inch thick ribbed PVC liner of DURO Hardness A of 80 and minimum dielectric strength of 450 volts per mil.
- F. Approved Manufacturers:
  - 1. Pipeline Seal and Insulator, Inc.
  - 2. Cascade Waterworks Manufacturing Company.
  - 3. Advanced Products and Systems, Inc. (APS).
- G. Casing End Seals.
  - 1. Approved Manufacturers:
    - a. Pipeline Seal and Insulator, Inc., Model S or C.
    - b. Maloney Technical Products, MULTIFLEX End Seal.
    - c. Advanced Products and Systems, Inc. (APS).
- H. Steel Strapping: ASTM A36 - Standard Specification for Carbon Structural Steel.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify connection to existing piping system size, location, and invert elevations are in accordance with Drawings.

### 3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities indicated to remain from damage.
- C. Notify utility company to remove and relocate utilities.
- D. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- F. Establish elevations of casing pipe.
- G. Establish minimum separation of water distribution piping from sanitary sewer piping in accordance with the Texas Commission on Environmental Quality (TCEQ).

### 3.3 DEWATERING

- A. Intercept and divert surface drainage precipitation and groundwater away from excavation through use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Develop substantially dry subgrade for prosecution of subsequent operations.
- C. Comply with Texas Commission on Environmental Quality (TCEQ) requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

### 3.4 EXISTING WORK

- A. Maintain access to existing facility and other remaining active installations requiring access. Modify installation as necessary to maintain access.

### 3.5 PITS OR APPROACH TRENCHES

- A. Excavate approach trenches or pits in accordance with shop drawings and as site conditions require.
- B. Ensure casing entrance face as near perpendicular to alignment as conditions permit.
- C. Establish vertical entrance face at least 1 foot above top of casing.
- D. Install dewatering measures and excavation supports as specified in Sections 31 23 16 – Excavation and 31 23 17- Trenching.

### 3.6 CASING PIPE INSTALLATION

- A. Boring:

1. Push pipe into ground with boring auger rotating within pipe to remove spoil. Do not advance cutting head ahead of casing pipe except for distance necessary to permit cutting teeth to cut clearance for pipe. Arrange machine bore and cutting head to be removable from within pipe. Arrange face of cutting head to provide barrier to free flow of soft material.
2. When unstable soil is encountered during boring retract cutting head into casing to permit balance between pushing pressure and ratio of pipe advancement to quantity of soil.
3. When voids develop greater than outside diameter of pipe by approximately one inch, grout to fill voids.
4. When boring is obstructed, relocate, jack, or tunnel as directed by City.

B. Jacking

1. Construct adequate thrust wall normal to proposed line of thrust.
2. Impart thrust load to pipe through suitable thrust ring sufficiently rigid to ensure uniform distribution of thrust load on full pipe circumference.

C. Drilling and Jacking

1. Use oil field type rock roller bit or plate bit made up of individual roller cutter units solidly welded to pipe which is turned and pushed for its entire length by drilling machine to give bit necessary cutting action.
2. Inject high density slurry (oil field drilling mud) to head as cutter lubricant. Inject slurry at rear of cutter units to prevent jetting action ahead of pipe.

### 3.7 PRESSURE GROUTING

- A. Pressure grout annular space between casing pipe and surrounding earth. Pressure grouting shall occur within 7 days after casing pipe has been installed.

### 3.8 CARRIER PIPE INSTALLATION

- A. Clean, inspect, and handle pipe in accordance with Sections 33 11 13 – Public Water Distribution Piping and Appurtenances and 33 31 13 – Public Sanitary Utility Sewerage Piping.
- B. Place carrier pipe in accordance with Sections 33 11 13 – Public Water Distribution Piping and Appurtenances and 33 31 13 – Public Sanitary Utility Sewerage Piping. Exercise care to prevent damage to pipe joints when carrier pipe is placed in casing.
- C. Support pipeline within casing so no external loads are transmitted to carrier pipe. Attach supports to barrel of carrier pipe; do not rest carrier pipe on bells.
- D. Grout ends of casing to seal.

### 3.9 TOLERANCES

- A. Do not over cut excavation by more than 1 inch greater than outside diameter of casing pipe.
- B. Install casing pipe to vertical and horizontal alignment on Drawings within plus or minus 2 inches prior to installation of carrier pipe.

- C. Install pipe bells with minimum 1 inch clearance to casing.

### 3.10 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

### 3.11 MANUFACTURER'S FIELD SERVICES

- A. Furnish field technical assistance during following periods of casing installation:
  - 1. Unloading of casing materials and components.
  - 2. Prior to commencing excavation and during excavation as requested.

### 3.12 REMOVAL OF FACILITIES AND CONTROLS

- A. Remove temporary facilities for casing installation and jacking operations.

END OF SECTION

## SECTION 33 11 13 - PUBLIC WATER DISTRIBUTION PIPING AND APPURTENANCES

### PART 1 GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Water piping.
2. Tapping Sleeves and Valves.
3. Valves.
4. Fire Hydrants.
5. Turbine Water Meters.
6. Air Release Valves.
7. Combination Air Valves (Air Release and Air/Vacuum Valves).
8. Underground pipe markers.
9. Precast concrete valve vaults and meter boxes.
10. Concrete encasement and cradles.
11. Bedding, embedment, and backfill materials.
12. Accessories.
13. Deflection Testing.
14. Pressure and Leakage Testing.

#### 1.2 UNIT PRICE – MEASUREMENT AND PAYMENT

##### A. Pipe [and Fittings]:

1. Basis of Measurement: Pipe will be measured by the linear foot along the centerline of the pipe for the various sizes and classes of pipe in place, in accordance with these specifications, complete and accepted by the City, including excavation, embedment, and backfill, unless they are included in the bid as a pay item. Where branches or connections to existing pipe lines are involved, measurement of the new connecting pipe will be made from the intersection of its central axis with the outside surfaces of the pipe into which it connects. Where structures are included in lines of pipe, that length of pipe tying into the structure wall will be included for measurement but no other portion of the structure length or width will be so included.
2. Basis of Payment: Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot for the various sizes of pipe, of the materials and class indicated. Payment shall be full compensation in accordance with pay items set in the bid, for excavation, furnishing, hauling and placing pipe including [fittings], lugs, and all incidentals and subsidiary materials and work; preparing, shaping, dewatering and shoring of trenches; hauling, placing and preparing bedding; for connecting to new or existing systems or structures; for hauling, moving, placing and compacting backfill materials (Street Trench or Off Street Trench), disinfection testing and pressure and leakage testing and for all other incidentals necessary to complete the pipe installation as indicated.

##### B. Fittings

1. Basis of Measurement: Per each, for the size and description of each fitting.
2. Basis of Payment: Ductile Iron fittings of the pressure class indicated, furnished and installed in accordance with these specifications will be paid for at the unit price bid per

each, complete in place, according to AWWA C110-ANSI Standard (or AWWA C153 – ANSI Standard) for Ductile Iron fittings (including glands, bolts, gaskets, etc.

- C. Turbine Water Meter:
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Shall be paid for per each, complete in place. Includes meter, fittings and accessories, and for furnishing all labor, material, tools, equipment, and incidentals necessary to complete the work.
- D. Wet Connections to Water Main:
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Shall be paid for per each, complete in place, according to the size of the main that is in service and shall be full compensation for all work required to make the connection and place the pipe in service. All fittings necessary for the wet connection shall be incidental, unless noted otherwise.
- E. Valves (Resilient Wedge Gate Valves):
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Includes excavation, valve, valve box, accessories, tests, backfill, and for furnishing all labor, material, tools, equipment, and incidentals necessary to complete the work.
- F. Fire Hydrant Assembly:
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Includes excavation, fire hydrant, M.J. Tee, 6-inch ductile iron pipe, 6-inch resilient-seat gate valve, valve box, pipe restraints, thrust blocking, “gradelok,” appurtenances, tests, embedment, and backfill, and for all other incidentals necessary to complete the fire hydrant installation.
- G. Blow Off Valve Assemblies:
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Includes excavation, valve assembly, appurtenances, tests, backfill, and for furnishing all labor, material, tools, equipment, and other incidentals necessary to complete the work.
- H. Tapping Sleeve and Valve:
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Includes excavation, sleeve and valve, appurtenances, tests, backfill, and for furnishing all labor, material, tools, equipment, and other incidentals necessary to complete the work.
- I. Air Release Valves:
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Includes excavation, air release valve, appurtenances, tests, backfill, and for furnishing all labor, material, tools, equipment, and other incidentals necessary to complete the work.
- J. Combination Air Valves:
  - 1. Basis of Measurement: Per each.

2. Basis of Payment: Includes excavation, combination air valve (air release and air/vacuum valve) and vault, appurtenances, tests, backfill, and for furnishing all labor, material, tools, equipment, and other incidentals necessary to complete the work.

### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

### 1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of piping mains, valves, fire hydrants, connections, thrust restraints, and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- C. Testing Reporting:
  1. Type and form of disinfectant used.
  2. Date and time of disinfectant injection start and time of completion.
  3. Test locations.
  4. Name of person collecting samples.
  5. Initial and 24 hour disinfectant residuals in treated water in ppm for each outlet tested.
  6. Date and time of flushing start and completion.
  7. Disinfectant residual after flushing in ppm for each outlet tested.
- D. Bacteriological Report:
  1. Date issued, project name, and testing laboratory name, address, and telephone number.
  2. Time and date of water sample collection.
  3. Name of person collecting samples.
  4. Test locations.
  5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
  6. Coliform bacteria test results for each outlet tested.
  7. Certify water conforms, or fails to conform, to bacterial standards of public water supply entity.
- E. Water Quality Certificate:
  1. Certify water conforms to quality standards of public water supply entity, suitable for human consumption.
- F. Testing:
  1. Perform Work in accordance with AWWA C651 – Disinfecting Water Mains.
  2. Laboratory approved by the Texas Health Department and Texas Commission on Environmental Quality (TCEQ).

### 1.5 QUALITY ASSURANCE

- A. Valves: Mark valve body with manufacturer's name and pressure rating.
- B. Fire Hydrants: Provide uniform color scheme in accordance with NFPA 281 and in accordance with the public water supply entity.



## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.
- B. Block individual and stockpiled pipe lengths to prevent moving.
- C. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- D. Store products in areas protected from sunlight, weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

## 1.7 EXISTING CONDITIONS

- A. Verify field measurements prior to fabrication. Indicate field measurements on shop drawings.

# PART 2 PRODUCTS

## 2.1 WATER PIPING

- A. Ductile Iron Pipe: AWWA C150 – Thickness Design of Ductile Iron Pipe, and C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water, of the class indicated. Asphaltic outside coating: AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast. Cement-Mortar Lining: AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water, double thickness cement-mortar lining with asphaltic seal coat. Polyethylene Encasement: AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - 1. Pipe Class: As indicated on the Drawings and conforming to AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water, for nominal thickness, rated water working pressure and maximum depth of cover.
  - 2. Fittings: Ductile iron, AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1,219 mm), for Water, Class 350; or compact fittings AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service, Class 350. Shall be North American Fabricated. Foreign fittings shall not be allowed. Two layers of Polyethylene Encasement wrap.
    - a. Coating and Lining:
      - 1) Asphaltic Coating: AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1,219 mm), for Water.
      - 2) Cement-Mortar Lining: AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water and C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings, double thickness cement and seal coated.
  - 3. Joints:
    - a. Mechanical and Push-On Pipe Joints: AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
      - 1) Wedge Action Restraining Gland for Ductile Iron Mechanical Joints.
        - a) Materials:

- (1) Gland body, wedge segment, and actuating bolts per ASTM A536 - Standard Specification for Ductile Iron Castings, 64-45-12 ductile iron.
  - (2) Wedge Segments: heat treated to a minimum hardness of 370 BHN.
  - (3) Tee-head Bolts and Nuts: ASNI/AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings /A21.11; ASTM A242 - Standard Specification for High-Strength Low-Alloy Structural Steel, High Strength Low Alloy Weathering Steel, Core-Ten A (modified to meet ANSI/AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings /A21.11) coated with fluoropolymer coating. Apply anti-seize lubricant on nuts to prevent hardware galling or seizure.
- b) Approved manufacturers for DIP Mechanical Joint Restraints:
  - (1) EBAA Iron Sales Inc.: Series 1100 "MEGALUG."
  - (2) SIGMA Corporation: ONE-LOK Series D-SLDE.
  - (3) Romac Industries, Inc.: RomaGrip.
  - (4) Tyler Union: TUFGrip.
- 2) Gaskets: AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- b. Flanged Joints: AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings, and C115 - Standard for Flanged Ductile-Iron Pipe With Threaded Flanges.
  - 1) Bolts: ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature and High Pressure Service, Grade B8M, Class 2 Stainless Steel, AISI 316.
  - 2) Nuts: ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, Grade 8M, Stainless Steel, AISI 316; cold punched, hexagonal, trimmed and chamfered. Apply anti-seize lubricant per manufacturer's instructions to prevent hardware galling or seizure.
  - 3) Insulating Sleeves and Washers: One-piece integral sleeves and washers manufactured of high-density polyethylene, NEMA grade LE phenolic, or Mylar, by Advance Products and Systems, Inc., or equal.
  - 4) Gaskets: Full faced, 1/8-inch minimum thickness SBR (Styrene Butadiene) elastomer per ANSI/AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings, A21.11. Flange gaskets shall be the high-performance type rated for a water working pressure of 350 psi for 4-inch through 24-inch diameters; 250 psi for 30-inch through 48-inch diameters; and 150 psi for 54-inch through 64-inch diameters.
    - a) Approved Manufacturers: U.S. Pipe and Foundry Co.: "Full Face Flange-Tyte," or equal.
- c. Restrained Joints:
  - 1) "Push-on Pipe" Joint Restraint: Section 33 05 19 – Pressure Piping Tied Joint Restraint System.
  - 2) Proprietary Restrained, Integral, Boltless, Flexible, Push-on Joint Pipe and Fittings: Restrained joint pipe, fittings, and restraining components shall be Ductile Iron in accordance with these Specifications. The restrained joint shall be manufactured integrally with the pipe and shall have a working pressure rating equivalent to the working pressure of the parent pipe. The restrained

joint pipe and fittings shall utilize a conventional gasket for Mechanical and Push-on Joints.

- a) Approved Manufacturers:
    - (1) U.S. Pipe and Foundry Co.: TR FLEX for 4-inch through 36-inch pipe diameters.
    - (2) Griffin Pipe Products Co.: SNAP-LOK for 6-inch through 48-inch pipe diameters.
    - (3) American Cast Iron Pipe Co.: Flex-Ring for 4-inch through 48-inch pipe diameters and Lok-Ring for 54-inch through 64-inch pipe diameters.
    - (4) Clow Water Systems Company: TR FLEX for 4-inch through 36-inch pipe diameters.
  - b) Thrust blocking is not required on proprietary restrained, integral, boltless, flexible, push-on joint pipe and fittings, unless specified otherwise.
4. Thrust-Blocking: As indicated on the Drawings.
  5. Jackets: All ductile iron water pipe and fittings shall be double wrapped with 8 mil (minimum) polyethylene film meeting AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems, with all edges and laps taped (with polyethylene tape) securely to provide a continuous wrap to prevent contact between the pipe and the surrounding backfill and bedding material. Repair rips, punctures, or other damage to the polyethylene wrap with polyethylene tape.
  6. Ductile Iron Pipe Installed Above Grade or in Below Ground Concrete Vaults:
    - a. Flanged Ductile Iron Pipe: AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges and as per "Ductile Iron Pipe," above, with the following exception:
      - 1) Pipe and fittings exposed to view in the finished work are to be painted in accordance with the specifications. Pipe shall not receive the standard bituminous coating on the outside surfaces but shall be shop primed on the outside with one coat of Kop-Coat No. 621 Rust Inhibitive Primer or equal.
      - 2) Bolts and Nuts:
        - a) Bolts: ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature and High Pressure Service, Grade B8M, Class 2 Stainless Steel, AISI 316.
        - b) Nuts: ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, Grade 8M, Stainless Steel, AISI 316. Washers: Stainless Steel (SS 316). Apply anti-seize lubricant in accordance with manufacturer's instructions to prevent hardware galling or seizure
- B. Polyvinyl Chloride (PVC) Water Pipe: All polyvinyl chloride (PVC) water pipe shall be of the rigid (UNPLASTICIZED) type and must bear the National Sanitation Foundation seal of approval for potable water pipe. Each joint of pipe shall consist of single continuous extrusion; bells or other components attached by solvent welding are not acceptable. Pipe in sizes 4 inches through 60 inches in diameter shall conform to the applicable requirement of AWWA C900-16 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 60 In., for Water Distribution, and shall be pressure rated at 305 psi (DR 14), 235 psi (DR 18), 200 psi (DR 21), or 165 psi (DR 25) as indicated.
1. Fittings: Fittings shall be ductile iron and shall conform to the requirements of AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76

mm through 1,219 mm), for Water, Class 350; or compact fittings AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service, Class 350. Fittings shall be mechanical restrained joints and conform to the ductile iron pipe specifications outlined herein and shall be North American fabricated. Two layers of Polyethylene Encasement wrap per AWWA C105 – ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

2. Joints:

- a. Push-on Joints: AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings. Pipe shall have push-on, rubber gasket joints of the bell and spigot type with thickened integral bells manufactured on the pipe. The wall thickness of each pipe bell and joint coupling must be greater than the standard pipe barrel thickness. Clearance must be provided in every gasket joint for both lateral pipe deflection and for linear expansion and contraction. The sealing ring groove in the coupling shall be of the same design as the groove in cast iron fittings. Solvent welding of PVC water pipe shall not be allowed.
- b. Restrained Joints:
  - 1) Mechanical Joints: AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings, and per Paragraph 2.1(A)(3) as specified above.
  - 2) “Push-on” Pipe Tied Bell Joint: Section 33 05 19 – Pressure Piping Tied Joint Restraint System.
- c. Approved manufacturers for PVC Pipe Mechanical Joint Restraints:
  - 1) EBAA Iron Sales, Inc.: Series 2000PV for 3-inch through 36-inch diameters and Series 2200 for 36-inch through 48-inch diameters.
  - 2) SIGMA Corporation: ONE-LOK Series D-SLCE.
  - 3) Romac Industries, Inc.: PVC RomaGrip.
  - 4) Tyler Union: TUFGRIP.

- C. Steel Pipe: AWWA C200 - Steel Water Pipe 6 In. (150 mm) and Larger, Fabricated Pipe, minimum wall thickness 0.375 inches for pipe diameters up to 8 inches; 0.50 inches for pipe diameters greater than 8 inches. Internal design pressure shall be as indicated on Drawings.
1. Fittings and Special Sections: AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
  2. Flanges: AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In., Class E or F as indicated on Drawings.
  3. Field Welding Materials:
    - a. Pipe: AWWA C206 - Field Welding of Steel Water Pipe.
    - b. Joints: AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied.
  4. Interior Cement Mortar Lining: AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied. Cement for mortar lining shall conform to ASTM C150 – Standard Specification for Portland Cement, and shall be Type II. No fly ash allowed.
  5. Buried Steel Pipe Exterior Lining:
    - a. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied, reinforced cement-mortar coating. Reinforcement shall be steel wire of a minimum size of WO.5 (ASTM A82) or WO.5 x WO.5 welded wire fabric (ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete, or ASTM A497 - Standard Specification for

Steel Welded Wire Reinforcement, Deformed, for Concrete). Cement for mortar coating shall conform to ASTM C150 - Standard Specification for Portland Cement and shall be Type II. No fly ash allowed.

6. Exterior Coating of Exposed Piping: AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines, fusion-bonded epoxy coating.
7. Bolts and Nuts:
  - a. Bolts: ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature and High Pressure Service, Grade B8M, Class 2 Stainless Steel, AISI 316.
  - b. Nuts: ASTM A194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, Grade 8M, Stainless Steel, AISI 316. Washers: Stainless Steel (SS 316). Apply anti-seize lubricant in accordance with manufacturer's instructions to prevent hardware galling or seizure.

## 2.2 TAPPING SLEEVES

### A. Tapping Sleeves:

1. Manufacturers:
  - a. Ford Meter Box Co., Inc.: Style FAST Tapping Sleeve
  - b. PowerSeal Corporation: Model 3480.
  - c. Romac Industries, Inc.: Model SST
2. Description: The tapping sleeve shall be made completely of stainless steel. The tapping sleeve shall have a flange face gasket, branch sealing gasket, and complete circle gasket all permanently attached to the sleeve from the factory. All welding shall be passivated so as to return the welded stainless steel to its original corrosion resistant state. There shall be no paper or plastic adhesive labels attached to the sleeve, any information appearing on the sleeve shall be stenciled. The tapping sleeve shall be rated for a minimum working pressure of 150 psi. Test plug is required.
3. Material Specifications: The shell shall be 18-8 Type 304 stainless steel or equal. The flange shall be 18-8 Type 304 stainless steel. Carbon steel flanges are not acceptable. The flange shall conform to AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In., Class D ANSI 150 drilling. The armor plate shall be 18-8 Type 304 stainless steel, bonded to the complete circle gasket. The bolts and nuts shall be 18-8 Type 304 stainless steel 5/8" NC threads. Either shall be coated to prevent galling or seizing. The gaskets shall be of virgin Buna-N or equal, compounded for water service.

## 2.3 VALVES

### A. Resilient Wedge Gate Valves:

1. Manufacturers:
  - a. American Flow Control.
  - b. Clow Valve Company.
  - c. Mueller Co.

- B. Resilient Wedge Gate Valves (for Gate Valves 3-inch through 24-inch diameters): AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; and AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; ductile iron body; including the manufacturer's name, pressure rating, and year of fabrication cast into valve body.

1. Gate: Resilient seat.
2. Stem: Non-rising stem.
3. Seals: O-ring stem seals.
4. Operating Nut: 2-inch square; open counterclockwise unless otherwise indicated.
5. Ends: Flanged or mechanical joint end connections. Flanged ends shall conform to AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1,219 mm), for Water. Mechanical joint ends shall conform to AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
6. Coating: AWWA C550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants; epoxy-coated interior/exterior.
7. Sizes 12-inch diameter and smaller: 200 psig pressure rated.
8. Sizes 16- inch diameter through 24-inch diameter: 150 psig pressure rated.
9. Valves shall be installed in a vertical position.
10. Tapping valves shall have lip for tapping machine.
11. The number of turns to fully open or close a valve shall be 3 times the diameter plus 2.
12. All external nuts, bolts, and washers shall be as specified herein.
13. Mechanical joint end connections shall be connected to the pipe with a Wedge Action Restraining Gland for Ductile Iron Mechanical Joint as specified herein.

#### C. GATE VALVE BOXES

1. 12-inch Diameter Valves and Smaller: Ductile iron, two-piece, screw type.
2. 12-inch through 20-inch Diameter Valves: Ductile or Cast iron, three-piece, screw type; round base.
3. Cast iron lid, marked "Water".
4. Includes stainless steel valve stem extension for deep bury installation.

### 2.4 FIRE HYDRANTS

#### A. Manufacturers:

1. American Cast Iron Pipe Company: American Darling B-84-B.
2. Clow Valve Co.
3. Mueller Co.: Centurion.
4. U.S. Pipe: Metropolitan.
5. M&H Valve Co.

#### B. Dry-barrel Break-away Type: AWWA C502 – Dry-Barrel Fire Hydrants; Factory Mutual Research Corporation and Underwriter’s Laboratories UL 246 Standard.

1. Rated Working Pressure: 200 psi.
2. Test Pressure: 400 psi.
3. Body: Cast iron.
4. Main Valve Closure: Compression type, opening against pressure and closing with pressure.
5. Traffic “breakaway” type with safety stem coupling and breakable flanges that permits full 360 degree rotation of the nozzle section.
6. Bury Depth: 3.5 feet.
7. Inlet Connection: 6 inches.
8. Valve Opening: 5-1/4 inches diameter designed to permit removal of all working parts (including waste valve) from top of hydrant without disturbing the surface adjacent to the hydrant and without disassembling the ground-line joint or nozzle connections.

9. Ends: Mechanical Joint (with wedge-type restraints).
10. Fittings: Ductile iron pipe as specified herein.
11. Bolts and Nuts: As specified herein.
12. Operating Nut: Tapered, pentagon (five sided) measuring ½ inch point to flat and 1 inch flat measurement (National Standard).
13. Direction of Opening: Counterclockwise unless otherwise indicated.
14. Fire Hydrant Leads: Ductile iron pipe as specified herein.
15. Hydrant Bonnet Assembly: Provide with a lubrication reservoir that automatically circulates lubricant to all operating stem threads and bearing surfaces each time the hydrant is operated. Downward stem travel limited by a travel stop located in the upper housing of the hydrant.
16. Hydrants shall be provided with a minimum of one internal and two external automatic and positively operating non-corrodible drain valves so as to allow main pressure to flush the drain valves completely during the opening motion and drain the hydrant completely when the main valve is shut. Drain valves operating by gravity or springs are not acceptable. Outlets for drainage of the barrel shall be made of bronze or non-corrodible metal or bushed therewith completely from the valve to the outside.

C. Outlets/Nozzles

1. Two Hose Outlets: 2-1/2 inch outlet per National Standard.
2. One Pumper Outlet: National Standard fire hose coupling screw threads, AWWA C502-73 - Dry-Barrel Fire Hydrants, Appendix A, Table A-2. 4-1/2 inch nominal size of hose coupling.
3. Caps furnished for the two hose nozzles and 1 pumper nozzle. Threads for nozzles/caps per National Standard.

D. Coating: AWWA C550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1. Exterior Finish: Primer and two coats of epoxy color in red.

E. Interior: Epoxy

## 2.5 TURBINE WATER METERS

A. Manufacturer and Model:

1. Sensus: OMNI T<sup>2</sup>.

B. Description: AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service, Class II, turbine meter assembly meeting NSF/ANSI Standard 61, Annex F and G.

C. Meter: Brass body turbine meter with magnetic drive register.

1. Service: Cold water, 122 degrees F.
2. Maximum Operating Pressure: 150 psi.
3. Accuracy: 1-1/2 percent.
4. Maximum Counter Reading: 100 million gallons.

D. Valve Box Aligner:

1. High-strength, plastic device designed to automatically center valve box base and prevent valve box base from shifting off center during backfilling.

## 2.6 AIR RELEASE VALVES

- A. Manufacturer and Model:
  - 1. APCO Valve and Primer Corporation: APCO Model No. 200A.
- B. Description: AWWA C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service. Cast Iron Body (ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings, Grade B); stainless steel float, plug, guide shafts, and bushings (ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; T304 Stainless Steel).

## 2.7 COMBINATION AIR VALVES (AIR RELEASE AND AIR/VACUUM VALVES)

- A. Manufacturer and Model:
  - 1. APCO Valve and Primer Corporation: APCO Model No. 145C.
- B. Description: AWWA C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service. Cast Iron Body (ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings, Grade B); stainless steel float, plug, guide shafts, and bushings (ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; T304 Stainless Steel).

## 2.8 UNDERGROUND PIPE MARKERS

- A. Pipe shall be identified in conformance with AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. as appropriate.
- B. Description: Detectable Ribbon Tape: Blue colored, continuously printed, metallic, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

## 2.9 PRECAST CONCRETE VALVE VAULTS AND METER BOXES

- A. Precast Concrete Valve Vaults and Meter Boxes: Conform to Section 33 05 16 – Utility Structures.

## 2.10 PIPE SUPPORTS AND ANCHORING

- A. Metal for pipe support brackets: Structural steel, galvanized and thoroughly coated with bituminous paint.
- B. Tie rods and clamps or lugs: Stainless steel, AISI Type 304.

## 2.11 CONCRETE ENCASEMENT AND CRADLES

- A. Concrete: Conform to Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements, 2000 psi 28 day concrete, air entrained rough troweled finish.



## 2.12 BEDDING, EMBEDMENT, AND BACKFILL MATERIALS

- A. Bedding Material: As specified in Section 31 23 17 - Trenching.
- B. Embedment Material: as specified in Section 31 23 17 - Trenching.
- C. Backfill Material: as specified in Section 31 23 17 - Trenching.

## 2.13 ACCESSORIES

- A. Concrete for Thrust Restraints: Conform to Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.
- B. Steel Rods, Bolts, Lugs, and Brackets: Conform to 33 05 19 – Pressure Piping Tied Joint Restrain System, unless indicated otherwise.
- C. Protective Coating: Bituminous paint.

## 2.14 DISINFECTION CHEMICALS

- A. Chemicals:
  - 1. AWWA B300 - Hypochlorites.
  - 2. AWWA B301 - Liquid Chlorine.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify that the existing utility water main size, location, and invert are as indicated on Drawings.
- B. Verify invert elevations of existing work prior to excavation and installation of valves and fire hydrants.

## 3.2 PREPARATION

- A. Pre-Construction Site Photos:
  - 1. Take photographs along centerline of proposed pipe trench; minimum one photograph for each 50 feet of pipe trench.
  - 2. Show mail boxes, curbing, lawns, driveways, signs, culverts, and other existing site features.
  - 3. Include project description, date taken and sequential number on back of each photograph.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.
- C. Remove scale and dirt on inside and outside before assembly.

- D. Prepare pipe connections to equipment with flanges or unions.

### 3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 - Trenching for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- C. Provide sheeting and shoring in accordance with Sections 31 23 15 – Trench Safety Systems and 31 23 17 - Trenching.
- D. Bedding shall be required to bring the trench bottom up to grade and shall be the same material as the embedment. The bedding shall be contoured at each belled joint to permit proper joint assembly while maintaining uniform pipe support.
- E. Place bedding to a compacted depth as indicated on the Drawings and in accordance with Section 31 23 17 - Trenching.
- F. Maintain optimum moisture content of bedding material to attain the required compaction density.

### 3.4 INSTALLATION - PIPE

- A. Install pipe in accordance with AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances, and/or AWWA C605 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water, whichever is applicable.
- B. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings.
- C. Joint Deflection: Deflection at the joint shall not exceed 1.5 degrees or 75% of the maximum deflection recommended by the manufacturer, whichever is less.
- D. Maintain 9 ft horizontal separation of water main from sanitary sewer piping in accordance with TCEQ Chapter 290.
- E. Install all buried piping to the lines and grades as shown on the Drawings. All underground piping shall slope uniformly between joints where elevations are shown.
- F. Install ductile iron piping and fittings to AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
- G. Route pipe in straight line. Relay pipe that is out of alignment or grade.
- H. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by City.

- I. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.
- J. Prevent newly installed waterline from becoming contaminated with groundwater. If contamination occurs, the entire length of pipe affected shall be thoroughly cleaned prior to installing additional pipe.
- K. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- L. Take sanitary precautions during waterline installation in accordance with AWWA standards. Precautions include keeping pipe clean and capping or otherwise effectively covering open pipe ends to exclude insects, animals, foreign material, debris, or other sources of contamination from unfinished pipe lines at times when construction is not in progress.
- M. Close pipe openings with watertight plugs during work stoppages and at the conclusion of each day's work. Trenches shall not be left open overnight. After installation of the temporary night cap, the trench shall be backfilled to provide blocking to keep the night cap in place and prevent floatation of the pipe in the event of rainfall events or excessive groundwater. Backfill of the excavation will not be required to meet the density requirements for trench backfill. Contractor shall provide a submittal for the night cap fitting for approval by City.
- N. Install access fittings to permit disinfection of water system.
- O. Establish elevations of buried piping with not less than 3.5 ft of cover for pipes less than 12 inches in diameter. Measure depth of cover from final surface grade to top of pipe barrel.
- P. Shore up and protect from damage all existing underground water lines and power lines, and all existing structures.
- Q. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- R. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on Drawings.
- S. Hold pipe securely in place while joint is being made.
- T. Do not walk on pipes in trenches until covered by embedment and tamped in place over pipe.
- U. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
- V. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be restrained and anchored.
- W. Embedment:

1. Place embedment beneath the haunches of the pipe, around sides of the pipe, and above the top of pipe in accordance with Section 31 23 17 - Trenching.
2. Maintain optimum moisture content of bedding material to attain required compaction density.

X. Backfill: Backfill trench in accordance with Section 31 23 17 – Trenching.

Y. Install plastic ribbon tape continuous over top of pipe buried 24 inches below finish grade above pipe line. Tape shall be continuous and shall not deviate outside the horizontal profile of the pipe.

Z. Stamp a “W” in curb face at all service locations on new construction.

### 3.5 INSTALLATION - VALVES AND HYDRANTS

A. Valves:

1. Install valves in conjunction with pipe laying; set valves plumb.
2. Provide buried valves with valve boxes installed flush with finished grade.

B. Fire Hydrants:

1. Install fire hydrants; provide support blocking and drainage aggregate; do not block drain hole.
2. Set hydrants plumb with pumper nozzle facing roadway; set hydrants with centerline of pumper nozzle 18 inches above finished grade and safety flange not more than 6 inches nor less than 2 inches above grade.
3. Paint hydrants in accordance with local color scheme.
4. After hydrostatic testing, flush hydrants and check for proper drainage.

### 3.6 INSTALLATION - TAPPING SLEEVES AND VALVES

A. Install tapping sleeves and valves in accordance with Drawings and in accordance with manufacturer’s instructions.

### 3.7 POLYETHYLENE ENCASEMENT

A. Encase ductile iron piping and fittings in 2 layers of polyethylene wrap to prevent contact with surrounding backfill material.

B. Install in accordance with AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

C. Terminate polyethylene encasement 3 to 6 inches above ground where pipe is exposed.

### 3.8 INSTALLATION - METERS

A. Install turbine meters in accordance with AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance, with isolating valves on the inlet and outlet. Install bypass with gate valve as indicated on the Drawings.

### 3.9 INSTALLATION - STUB OUTS

- A. All stub outs and their fittings for future water main and lateral extensions shall be mechanically restrained with Wedge Action Restraining Glands or Tied Joint Restraint Systems in accordance with Specification Section 33 05 19 – Pressure Piping Tied Joint Restraint System.

### 3.10 THRUST RESTRAINT

- A. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair. Provide thrust restraint bearing on subsoil in accordance with the Drawings.
- B. Install tie rods, clamps, set screw retainer glands, or restrained joints prior to the installation of the concrete thrust blocking.
- C. Install thrust blocks, tie rods, and joint restraint at dead ends of water main.

### 3.11 SERVICE CONNECTIONS

- A. Install service connections in accordance with Section 33 12 13 – Water Service Connections.

### 3.12 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Examination
  1. Verify piping system has been flushed at a minimum velocity of three feet per second at a 40 psi residual pressure such that all particles are removed from the line.
  2. Verify piping system has been pressure tested as specified herein.
  3. Perform scheduling and disinfection activity with start-up; water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.
- B. Disinfecting Procedure and Dosage:
  1. Disinfect all potable water pipelines and appurtenances per AWWA C651 - Disinfecting Water Mains.
  2. Provide equipment to perform the Work of this section.
  3. Provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used. Provide all required temporary pumps and storage facilities required to complete the specified flushing and disinfecting operations.
  4. Introduce treatment into one end of the piping system. A chlorine-water mixture shall be uniformly introduced into the pipeline by means of a solution-feed chlorinating device. The chlorine solution shall be introduced at one end of the pipeline through a tap in such a manner that as the pipeline is filled with water, the dosage applied to the water entering the pipe shall be a minimum of 50 mg/l. All valves, hydrants, etc. shall be operated to disinfect all parts. Care shall be taken to prevent the strong chlorine solution in the line being disinfected from flowing back into the line supplying the water.
  5. Maintain disinfectant in system for 24 hours. After 24 hours, the free chlorine residual of the chlorine-treated water at the extremities of the pipeline being tested shall be at least 25 mg/l.

6. After the 24-hour retention period, the water shall contain no less than 25 mg/l chlorine throughout the treated section of pipeline.
7. Repetition of Test: The disinfection testing procedure shall be repeated if the initial tests fail to produce satisfactory results. Two consecutive satisfactory test results shall be required after any unsatisfactory test.
8. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
9. Neutralization of Chlorinated Water: Neutralizing and disposing of chlorinated water shall be in accordance with Appendix "B" of AWWA Standard C651 - Disinfecting Water Mains.

C. Bacteriological Testing of Disinfected Pipelines

1. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test for bacteriological quality and certify water quality suitable for human consumption. Two sets of samples drawn 24 hours apart shall be taken at locations prescribed by AWWA C651. One test sample shall be drawn from the end of the main and additional samples collected at intervals not exceeding 1000 feet along the pipeline.
2. Install sufficient sampling taps at proper locations along the pipeline. Each sampling tap shall consist of a standard corporation cock installed in the line and extended with a copper tubing gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.
3. Samples for bacteriological analysis shall be collected only from suitable sampling taps in sterile bottles treated with sodium thiosulfate. Samples shall not be drawn from hoses, fire hydrants, etc.
4. Bacteriological testing shall be in accordance with the "Standard Methods for the Examination of Water and Wastewater," latest edition.
5. If the initial disinfection fails to produce acceptable sample tests, the disinfection procedure shall be repeated (without extra compensation) until satisfactory test results have been obtained before the piping may be placed in service.

### 3.13 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements.

B. Pressure and leakage test system in accordance with AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances and the following:

1. Test Pressure: Not less than 200 psi or 133% of the nominal pipe pressure class indicated, whichever is greater.
2. Conduct hydrostatic test for at least four-hour duration. Contractor shall furnish all pumps, gauges, and equipment necessary for the tests. The City must be present to observe the tests.
3. Test pressure shall not vary by more than  $\pm 5$  psi (24.5 kPa) for the duration of the test.
4. Fill section to be tested with water slowly. Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks and air vents shall be closed and the test pressure applied.

At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place as required by the specifications.

5. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be replaced with new material, and the test shall be repeated until satisfactory results are obtained.
6. Correct all observed deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
7. Compute maximum allowable leakage by the following formula:

|                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------|
| $L = (SD\sqrt{P})/C$                                                                                                                 |
| L = allowable leakage, in gallons per hour                                                                                           |
| S = length of pipe tested, in feet                                                                                                   |
| D = nominal diameter of pipe, in inches                                                                                              |
| P = average test pressure during hydrostatic test, in psig                                                                           |
| C = 148,000                                                                                                                          |
| When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size. |

8. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.
  9. No pipe installation will be accepted if the leakage is greater than the allowable determined by the formula prescribed above. If any test of laid pipe discloses leakage greater than that specified in (7), above, repairs or replacements shall be accomplished in accordance with the specifications.
  10. All visible leaks are to be repaired regardless of the amount of leakage.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

## SECTION 33 12 00 - WATER UTILITY DISTRIBUTION EQUIPMENT

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Reduced pressure backflow preventer assemblies.
  - 2. Double check valve backflow preventer assemblies.
  - 3. Pipe supports.

#### 1.2 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 - Submittal Procedures.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of backflow preventer assemblies.
- B. Operation and Maintenance Data: Submit spare parts list, exploded assembly views, and recommended maintenance intervals.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Materials:
  - 1. Furnish two sets of seals for each backflow preventer assembly.

#### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section.
- B. Installer: Company specializing in performing work of this section.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept backflow preventer assemblies, valves, and equipment on site in shipping containers with labeling in place. Inspect for damage.
- B. Furnish cast iron and steel valves with temporary protective coating.
- C. Furnish pipe and fittings with temporary end caps and closures. Maintain caps and closure in place until installation.
- D. Protect backflow preventer assemblies from entry of foreign materials by temporary covers.
  - 1. Protect openings in sections of completed piping systems.
  - 2. Protect openings in piping systems when Work is not in progress.

#### 1.7 EXISTING CONDITIONS

- A. Verify field measurements prior to fabrication. Indicate field measurements on shop drawings



## 1.8 WARRANTY

- A. Furnish five year manufacturer's warranty for backflow preventer assemblies.

## PART 2 PRODUCTS

### 2.1 BACKFLOW PREVENTERS

- A. Manufacturers:
  - 1. FEBCO
  - 2. Watts Water Technologies, Inc.
- B. Reduced Pressure Backflow Preventers with Detector Assembly:
  - 1. Size: **3/4 inch** to **2 inches**.
  - 2. Comply with ASSE 1047 - Performance Requirements for Reduced Pressure Detector Fire Protection Backflow Prevention Assemblies and AWWA C511 - Reduced-Pressure Principle Backflow Prevention Assembly.
  - 3. Bronze body, with bronze internal parts and stainless steel springs.
  - 4. Two independently operating, spring loaded check valves.
  - 5. Diaphragm type differential pressure relief valve located between check valves.
  - 6. Third check valve opening under back pressure in case of diaphragm failure.
  - 7. Furnish with two quarter-turn, full port resilient seated bronze, ball valves, strainer, and test cocks.
  - 8. Furnish two sets of seals for each assembly.
  - 9. Furnish five year manufacturer's warranty for backflow preventer assemblies.
- C. Reduced Pressure Backflow Preventers with Detector Assembly:
  - 1. Size: **3 inches** to **10 inches**.
  - 2. Comply with ASSE 1047 - Performance Requirements for Reduced Pressure Detector Fire Protection Backflow Prevention Assemblies and AWWA C511 - Reduced-Pressure Principle Backflow Prevention Assembly.
  - 3. Heavy duty cast iron construction with fusion epoxy coat inside and outside.
  - 4. Two independently operating, spring loaded check valves.
  - 5. Diaphragm type differential pressure relief valve located between check valves.
  - 6. Third check valve opening under back pressure in case of diaphragm failure.
  - 7. Furnish with two resilient seated gate valves, strainer, and four resilient seated, ball valve test cocks.
  - 8. Furnish two sets of seals for each assembly.
  - 9. Furnish five year manufacturer's warranty for backflow preventer assemblies.
- D. Double Check Valve Backflow Preventer with Detector Assembly:
  - 1. Size: **1/2 inch** to **2 1/2 inches**.
  - 2. Comply with ASSE 1048 - Performance Requirements for Double Check Detector Fire Protection Backflow Prevention Assemblies and AWWA C510 - Double Check-Valve Backflow Prevention Assembly.
  - 3. Bronze body with corrosion resistant internal parts.
  - 4. Stainless steel springs.
  - 5. Two independently operating check valves with intermediate atmospheric vent.

6. Furnish with two quarter-turn, full port resilient seated, bronze ball valves, strainer, and test cocks.
7. Furnish two sets of seals for each assembly.
8. Furnish five year manufacturer's warranty for backflow preventer assemblies.

E. Double Check Valve Backflow Preventer with Detector Assembly:

1. Size: **3 inches** to **10 inches**.
2. Comply with ASSE 1048 - Performance Requirements for Double Check Detector Fire Protection Backflow Prevention Assemblies and AWWA C510 - Double Check-Valve Backflow Prevention Assembly.
3. Heavy duty cast iron construction with fusion epoxy coat inside and outside.
4. Stainless steel springs.
5. Two independently operating check valves.
6. Furnish with two resilient seated, flanged, resilient-seated gate valves, and strainer.
7. Furnish two sets of seals for each assembly.
8. Furnish five year manufacturer's warranty for backflow preventer assemblies.

## 2.2 VALVE VAULT

- A. Valve Vault: Precast concrete, as specified in Section 33 05 16 – Utility Structures.

## 2.3 PIPING

- A. Refer to Section 33 11 13 – Public Water Utility Distribution Piping and Appurtenances.

## 2.4 PIPE SUPPORTS

- A. Manufacturers:
1. Anvil International.
- B. Floor Support for Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- C. Copper Pipe Support: Carbon steel ring, adjustable, copper plate.

## 2.5 EMBEDMENT AND BACKFILL MATERIALS

- A. Embedment: As specified in Section 31 23 17 - Trenching.
- B. Backfill: As specified in Section 31 23 17 - Trenching.

## 2.6 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size **3 inches** and Smaller:
1. Ferrous pipe: Class 150 malleable iron threaded unions.
  2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Grooved and Shouldered Pipe End Couplings:

1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
  2. Sealing gasket: "C" shape composition sealing- gasket.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

## 2.7 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavate.
- B. Verify piping connection, size, location and invert are as indicated on Drawings.

### 3.2 PREPARATION

- A. Remove scale and dirt, on inside and outside, before assembly.

### 3.3 INSTALLATION - VALVE VAULT

- A. Refer to Section 33 05 16 – Utility Structures.

### 3.4 INSTALLATION - PIPE SUPPORTS

- A. Pipe Supports:
1. Install pipe supports in accordance with MSS SP 89.
  2. Prime coat exposed supports.

### 3.5 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection to existing piping system with regard to size, location, and invert.
- B. Establish elevations of buried piping with not less than 3.5 ft of cover.
- C. Establish minimum 10 feet separation from sanitary sewer piping in accordance with TCEQ Regulations.
- D. Remove scale and dirt on inside of piping before assembly.
- E. Excavate pipe trench in accordance with Section 31 23 17 - Trenching.
- F. Install pipe to elevation as indicated on Drawings.

- G. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding **six inches** compacted depth; compact to 95 percent Standard Proctor density.
- H. Install pipe on prepared bedding.
- I. Route pipe in straight line.
- J. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- K. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
- L. Install plastic ribbon tape continuous over top of pipe buried **24 inches** below finish grade.
- M. Place embedment and backfill in accordance with Section 31 23 17 – Trenching.

### 3.6 INSTALLATION - INTERIOR PIPING SYSTEMS

- A. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Establish elevations of buried piping outside valve vault to obtain not less than **3.5 ft** of cover.
- C. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- D. Install water piping in accordance with ASME B31.9.
- E. Install unions downstream of valves and at equipment or apparatus connections.
- F. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

### 3.7 INSTALLATION - BACKFLOW PREVENTER ASSEMBLIES

- A. Install backflow preventer of type, size, and capacity indicated.
- B. Install air-gap fitting on units with atmospheric vent connection and pipe relief outlet drain to nearest floor drain.
- C. Do not install bypass around backflow preventer.

### 3.8 FIELD QUALITY CONTROL

- A. Section 01 40 00- Quality Requirements.
- B. Perform pressure test on backflow pressure assemblies installation with Section 33 11 13 – Public Water Distribution Piping and Appurtenances.
- C. Disinfect backflow preventer assemblies installation in accordance with Section 33 11 13 - Public Water Distribution Piping and Appurtenances.

### 3.9 CLEANING

END OF SECTION

## SECTION 33 12 13 - WATER SERVICE CONNECTIONS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Pipe and fittings for residential and commercial water service connections.
  - 2. Corporation stop assembly.
  - 3. Curb stop assembly.
  - 4. Water meters.
  - 5. Embedment and backfill materials.
  - 6. Meter boxes.

#### 1.2 PRICE AND PAYMENT PROCEDURES

- A. Water Services:
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Includes hand trimming excavation, pipe and fittings, meter box, corporation stop assembly, curb stop assembly, bedding, concrete thrust restraints, connection to municipal utility water source, and either connected, or not connected, to private water service. Short Service – service connection to the near side of street centerline. Long Service – service connection to the far side of street centerline.
    - a. \_\_\_\_ - Inch Water (Short or Long) Service and Not Connected – Per Each, Measured.
    - b. \_\_\_\_ - Inch Water (Short or Long) Service and Connect to Private Service (Existing Meter) – Per Each, Measured.
    - c. \_\_\_\_ - Inch Water (Short or Long) Service and Connect to Private Service (With New \_\_\_\_ - Inch Meter) – Per Each, Measured.
- B. Water Meters:
  - 1. Basis of Measurement: Per each.
  - 2. Basis of Payment: Includes meter, meter setting equipment, fittings and accessories.

#### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Identify and describe discovery of uncharted utilities.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.
- B. Store products and materials off ground and under protective coverings and custody, away from walls and in manner to keep these clean and in good condition until used.

- C. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

## PART 2 PRODUCTS

### 2.1 WATER SERVICE PIPING AND FITTINGS

- A. Copper Tubing: ASTM B88, Type K, Class 1 annealed:
  - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
  - 2. Joints: Compression connection or AWS A5.8, BCuP silver braze.

### 2.2 CORPORATION STOP ASSEMBLY

- A. Manufacturers:
  - 1. Mueller: Model 300
  - 2. Ford Meter Box Company, Inc.: Model FB 1000-4 or 7-G.
- B. Corporation Stops:
  - 1. Brass conforming to ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings, Table 1.
  - 2. Inlet end threaded for tapping according to AWWA C800 - Underground Service Line Valves and Fittings.
  - 3. Outlet end suitable for service pipe specified.
  - 4. Designed for 200 psi working pressure.
- C. Service Saddles:
  - 1. Double strap type: Smith Blair No. 317 Double Strap Saddle, or approved equal.
  - 2. Designed for 200 psi working pressure.

### 2.3 CURB STOP ASSEMBLY

- A. Manufacturers:
  - 1. The Ford Meter Box Company, Inc.: Model B11-444W-NL, or B11-777W-NL.
- B. Curb Stops:
  - 1. Brass conforming to ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings, Table 1.
  - 2. Plug type valve.
  - 3. Positive pressure sealing.
  - 4. Designed for 200 psi working pressure.

### 2.4 METER BOXES

- A. Pre-cast Concrete Meter Boxes
  - 1. Meter Boxes for 3/4 Inch and 1 Inch Meters (Traffic and Non-traffic Areas):
    - a. 13" x 24" Concrete Meter Box, concrete lid with cast iron hinged meter reading lid.
  - 2. Meter Boxes for 1 1/2 Inch Meters (Traffic and Non-traffic Areas):
    - a. 17" x 30" Concrete Meter Box, concrete lid with cast iron hinged meter reading lid.
- B. Water Meters 2 Inches and Larger: Refer to Section 33 05 16 – Utility Structures.

## 2.5 WATER METERS

- A. Residential Water Meters: Unless otherwise specified, meters shall be furnished by the City and installed by the Contractor.
- B. Commercial Water Meters:
  - 1. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service, Class II, turbine meter assembly meeting NSF/ANSI Standard 61, Annex F and G.
  - 2. Meter: Brass body turbine meter with magnetic drive register.
    - a. Service: Cold water, 122 degrees F.
    - b. Maximum Operating Pressure: 200 psi.
    - c. Accuracy: 1-1/2 percent.
    - d. Maximum Counter Reading: 100 million gallons.
  - 3. Manufacturers:
    - a. Sensus: OMNI T<sup>2</sup>, or approved equal.

## 2.6 UNDERGROUND PIPE MARKERS

- A. Detectable Ribbon Tape: Detectable, bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

## 2.7 PRECAST CONCRETE VAULT

- A. Refer to Section 33 05 16 – Utility Structures.

## 2.8 EMBEDMENT AND BACKFILL MATERIALS

- A. Embedment: As specified in Section 31 23 17- Trenching.
- B. Backfill: As specified in Section 31 23 17 - Trenching.

## 2.9 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements and indicated on the Drawings.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

## 3.2 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.



- C. Prepare pipe connections to equipment with flanges or unions.

### 3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

- A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the City.
- B. Provide service clamps for mains other than of cast iron or ductile iron mains.
- C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.
- D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.
- E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the City.

### 3.4 EMBEDMENT

- A. Excavate pipe trench in accordance with Section 31 23 17 – Trenching for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- C. Provide sheeting and shoring in accordance with Sections 31 23 15 – Trench Safety Systems and 31 23 17 - Trenching.
- D. Place embedment material at trench bottom; level embedment fill material in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent of standard Proctor density, as prescribed in Section 31 23 17 – Trenching.

### 3.5 INSTALLATION – WATER SERVICE

- A. Maintain separation of Water Service from sewer piping in accordance with TCEQ Regulations.
- B. Establish elevations of buried Water Service with not less than 3.0 ft of cover.
- C. Route tubing in straight line.
- D. Backfill trench in accordance with Section 31 23 17 - Trenching.
- E. Install Water Service to the right-of-way or property line, or as indicated on Drawings.

### 3.6 INSTALLATION - CURB STOP ASSEMBLY

- A. Set curb stops on compacted soil.
- B. Center and plumb curb box over curb stops. Set box cover flush with finished grade.

### 3.7 INSTALLATION - WATER METERS

- A. Install meters in accordance with AWWA M6 – Water Meters – Selection, Installation, Testing and Maintenance, with isolating valves on inlet and outlet as specified in Section 33 12 00 – Water Utility Distribution Equipment.

### 3.8 PRECAST CONCRETE VAULT

- A. Construct precast concrete as per Section 33 05 16 – Utility Structures.
- B. Seal vault joints watertight with preformed plastic joint sealant compound. Apply asphalt waterproofing to exterior walls.
- C. Seal annular space between pipe and wall sleeves as indicated on the Contract Drawings.
- D. Install vault covers and frames; adjust to finished grade elevation.

### 3.9 FIELD QUALITY CONTROL

- A. Section 01 40 00 – Quality Requirements.
- B. Pressure and leakage test services in accordance with AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances, and Section 33 11 13 – Public Water Distribution Piping and Appurtenances; Paragraph 3.13, “FIELD QUALITY CONTROL”.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

## SECTION 33 31 13 - PUBLIC SANITARY UTILITY SEWERAGE PIPING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Sanitary sewer pipe and fittings.
  - 2. Underground pipe markers.
  - 3. Connection to existing manholes.
  - 4. Wye branches.
  - 5. Sanitary Laterals.
  - 6. Bedding, embedment, and backfill materials.
  - 7. Sewer testing.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Pipe and Fittings:
  - 1. Basis of Measurement: Pipe will be measured by the linear foot along the centerline of the pipe for the various sizes and types of pipe in place, in accordance with these specifications, including excavation, embedment, and backfill.
    - a. Where wyes, branches or connection to existing pipe lines are involved, measurement of the new connecting pipe will be made from the intersection of its central axis with the outside surfaces of the pipe into which it connects. Where manholes or other structures are included in lines of pipe, that length of pipe tying into the structure wall will be included for measurement but no other portion of the structure length or width will be so included.
  - 2. Basis of Payment: Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot for the various sizes of pipe, of the types materials and class indicated.
    - a. Pipe: When called for in the Bid, pipe shall be paid for at the unit contract price bid per linear foot for the size and type of pipe specified at the depth specified, complete in place. The bid price per linear foot shall include all clearing, excavation, bedding material, fittings, plugs, lugs, pipe coatings, connection to the existing system, disposal of surplus materials, bedding, laying of pipe, embedment, backfilling and cleanup. Pipe shall be paid for either as Street Trench (areas subject to or influenced by vehicular traffic) or Off-Street Trench (area not subject to or influenced by vehicular traffic).
    - b. Measurement for depth shall be from the existing ground surface or proposed subgrade, whichever is less, over the centerline of the of the pipe as surveyed by the Engineer. As established in the bid, pipe including excavation, embedment, and backfill may be either (1) payment for any and all depths of pipe, or (2) payment in 5 foot incremental depths as follows: (0'-5' trench), (5'-10' trench), (10'-15' trench), (15'-20' trench), or (over 20' trench).
  - 3. Payment will also represent compensation for removal and replacement of pavement, curb, drainage structures, driveways and any other improvements damaged during construction.

- B. Sewer Services:
  - 1. Basis of Measurement: Per Each.
  - 2. Basis of Payment: Includes excavation, bedding, embedment, backfill, pipe and fittings, wye, adaptors, cleanout, box, and incidentals, complete and in-place.

### 1.3 SUBMITTALS

- A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

### 1.4 CLOSE-OUT SUBMITTALS

- A. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.

### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section.
- B. Installer: Company specializing in performing work of this section.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store fittings in shipping containers with labeling in place.
- B. Block individual and stockpiled pipe lengths to prevent moving.

## PART 2 PRODUCTS

### 2.1 SANITARY SEWER PIPE AND FITTINGS

- A. Sanitary Sewer Pipe: ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, SDR 26, Poly (Vinyl Chloride) (PVC) material; 4-inch through 15-inch, shall be manufactured in green; bell and spigot style rubber ring sealed gasket joint.
  - 1. Fittings: ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, SDR 35, PVC material.
  - 2. Joints: ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe, elastomeric gaskets.
- B. Sanitary Sewer Pipe: Solid Wall Sewer Pipe; ASTM F-679 – Standard Specification for Poly (Vinyl Chloride)(PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings; 18-inch through 60-inch. Pipe stiffness of 46psi or 115psi as shown on drawings.
- C. Sanitary Sewer Pressure Pipe: ASTM D2241 – Standard Specification for Poly(Vinyl Chloride)(PVC) Pressure Rated Pipe (SDR Series); 1 ½-inch through 12-inch; shall be manufactured in green; SDR 64 (63psi), SCR 41 (100 psi), SDR 32.5 (125 psi), SDR 26 (160 psi), SDR 21 (200 psi) or SDR 17 (250 psi) as shown on drawings.

## 2.2 SANITARY SEWER SERVICE PIPE AND FITTINGS

- A. Service Pipe: ASTM 3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, SDR 26 Poly (Vinyl Chloride) (PVC) material; bell and spigot style rubber ring gasket joint.
  - 1. Fittings: ASTM 3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, SDR 35, PVC material.
  - 2. Joints: ASTM 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe, elastomeric gaskets.

## 2.3 FLEXIBLE COUPLINGS

- A. Manufacturers:
  - 1. Fernco, Inc.
  - 2. The Metraflex Company.
  - 3. Siemens AG Water Technologies.
- B. Flexible Coupling: Resilient chemical-resistant elastomeric polyvinyl chloride (PVC) coupling, two Series 300 stainless steel clamps and stainless steel screws and housings.

## 2.4 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES

- A. Manufacturers:
  - 1. A-Lok.
  - 2. J-K Polysource, Inc.
  - 3. Trelleborg Pipe Seals Milford, Inc.
- B. Flexible Pipe Boot: ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals, ethylene propylene rubber (EPDM), Series 300 stainless steel clamp and stainless steel hardware.

## 2.5 CONCRETE ENCASEMENT AND CRADLES

- A. Concrete: Conforming to Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements, Class B, rough troweled finish, as indicated on Drawings.
- B. Concrete Reinforcement: Conform to Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements, when indicated.

## 2.6 MANHOLES

- A. Manholes: Conform to Section 33 05 14 –Manholes and Structures, as indicated on Drawings.

## 2.7 BEDDING, EMBEDMENT, AND BACKFILL MATERIALS

- A. As specified in Section 31 23 17 - Trenching.

## 2.8 ACCESSORIES

- A. Grout: Specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.

- B. Underground Pipe Markers:
  - 1. Detectable Warning Tape: Green colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

## 2.9 TESTING EQUIPMENT

- A. Air Test Equipment:
  - 1. Air compressor.
  - 2. Air supply line.
  - 3. Shut-off valves.
  - 4. Pressure regulator.
  - 5. Pressure relief valve.
  - 6. Stop watch.
  - 7. Plugs.
  - 8. Pressure gauge, calibrated to 0.1 psi.
- B. Infiltration Test Equipment:
  - 1. Weirs.
- C. Hydrostatic Test Equipment:
  - 1. Hydro pump.
  - 2. Pressure hose.
  - 3. Water meter.
  - 4. Test connections.
  - 5. Pressure relief valve.
  - 6. Pressure gauge, calibrated to 0.1 psi.
- D. Deflection Test Equipment:
  - 1. Go, no-go mandrels.
  - 2. Pull/retrieval ropes.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify trench excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

### 3.2 PREPARATION

- A. Correct over excavation with coarse aggregate.
- B. Remove large stones or other hard matter capable of damaging pipe or impeding consistent backfilling or compaction.
- C. Protect and support existing sewer lines, utilities and appurtenances.
- D. Maintain profiles of utilities. Coordinate with other utilities to eliminate interference. Notify City where crossing conflicts occur.

### 3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 - Trenching.
- B. Excavate to lines and grades shown on Drawings.
- C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- D. Provide sheeting and shoring in accordance with Section 31 23 15 – Trench Safety Systems and Section 31 23 17 - Trenching.
- E. Bedding shall be required to bring the trench bottom up to grade and shall be the same material as the embedment. The bedding shall be contoured at each belled joint to permit proper joint assembly while maintaining uniform pipe support.
- F. Place bedding to a compacted depth as indicated on the Drawings and in accordance with Section 31 23 17 - Trenching.
- G. Maintain optimum moisture content of bedding material to attain the required compaction density as specified in Section 31 23 17 - Trenching.

### 3.4 INSTALLATION - PIPE

- A. All wastewater installations to be in accordance with TAC (TCEQ) Chapter 217.
- B. Sanitary sewers that are parallel, or cross, waterlines shall be installed in accordance with the Texas Administrative Code (TAC), Rule 290.44.
- C. Install pipe, fittings, and accessories in accordance with ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- D. Lay pipe to slope gradients noted on Drawings.
- E. Assemble and handle pipe in accordance with manufacturer's instructions.
- F. Keep pipe and fittings clean until work is completed and accepted by City. Cap open ends during periods of work stoppage.
- G. Lay bell and spigot pipe with bells upstream.
- H. Connect pipe to existing sewer system at existing manhole as indicated on Drawings.
- I. Install detectable warning tape continuous over top of pipe buried 36 inches below finish grade above pipe line. Tape shall be continuous and shall not deviate outside the horizontal profile of the pipe.

### 3.5 INSTALLATION - CONNECTION TO EXISTING MANHOLE

- A. Core drill existing manhole to clean opening. Using pneumatic hammers, chipping guns, or sledge hammers is not permitted.
- B. Install watertight neoprene gasket and seal with non-shrink concrete grout.
- C. Prevent construction debris from entering existing sewer line when making connection.

### 3.6 INSTALLATION - MANHOLES

- A. Install manholes in accordance with Section 33 05 14 – Manholes and Structures.

### 3.7 INSTALLATION - WYE BRANCHES

- A. Install wye branches or pipe tees at locations indicated on Drawings concurrent with pipe laying operations. Use standard fittings of same material and joint type as sewer main.
- B. Use saddle wye or tee with stainless steel clamps for taps into existing piping. Mount saddles with solvent cement or gasket and secure with metal bands. Layout holes with template and cut holes with mechanical cutter.

### 3.8 INSTALLATION - SANITARY SEWER SERVICE LATERALS

- A. Construct sanitary sewer service laterals from wye branch to terminal point at right-of-way or as indicated on Drawings.
- B. Where depth of main pipeline warrants, construct riser type laterals from wye branch.
- C. Maintain 3 feet minimum depth of cover over pipe, or as indicated on Drawings.
- D. Install watertight plug, braced to withstand pipeline test pressure thrust, at termination of lateral. Install temporary marker stake extending from end of lateral to 12 inches above finished grade. Paint top 6 inches of stake with fluorescent orange paint.

### 3.9 EMBEDMENT

- A. Place embedment around sides and above the top of pipe in accordance with Section 31 23 17 - Trenching and as indicated on Drawings.
- B. Maintain optimum moisture content of embedment material to attain required compaction density.

### 3.10 CONCRETE ENCASEMENT

- A. Encase pipe in concrete when indicated on Drawings and in accordance with Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.



- B. All flexible adapters, bends, and tees on service lines shall be encased in 6 inches (minimum) of concrete in accordance with Section 32 30 00 - Cast-In-Place Concrete for Civil Site Improvements.

### 3.11 BACKFILL

- A. Place backfill above embedment material in accordance with Section 31 23 17 - Trenching and as indicated on Drawings.

### 3.12 FIELD QUALITY CONTROL

- A. Section 01 40 00 – Quality Requirements.
- B. Request inspection prior to and immediately after placing embedment.
- C. Sewer Pipe Testing per Paragraph 3.13 – Sewer Pipe Testing.
- D. Compaction Testing for Bedding, Embedment, and Backfill: In accordance with Section 31 23 17 - Trenching.
- E. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

### 3.13 SEWER PIPE TESTING

- A. Examination:
  - 1. Verify piping is ready for testing and that trenches are backfilled. Verify pressure piping concrete reaction support blocking or mechanical restraint system is installed.
- B. Piping Preparation:
  - 1. Lamping:
    - a. Lamp gravity piping after flushing and cleaning.
    - b. Perform lamping operation by shining light at one end of each pipe section between manholes; observe light at other end; reject pipe not installed with uniform line and grade; remove and reinstall rejected pipe sections; re-clean and lamp until pipe section achieves uniform line and grade.
  - 2. Plug outlets, wye-branches and laterals; brace plugs to resist test pressures.
- C. Testing Gravity Sewer Piping:
  - 1. Low-pressure Air Test:
    - a. Test each section of gravity sewer piping between manholes.
    - b. Introduce air pressure slowly to approximately 4 psig.
      - a) Determine ground water elevation above spring line of pipe for every foot of ground water above spring line of pipe, increase starting air test pressure by 0.43 psig; do not increase pressure above 10 psig.
    - c. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or increased test pressure as determined above when ground water is present. Start test.
    - d. Test:
      - a) Determine test duration for sewer section with single pipe size from the following table. Do not make allowance for laterals.

| Nominal Pipe Size, inches | Minimum Test Time, min/ 100 feet |
|---------------------------|----------------------------------|
| 6                         | 0.7                              |
| 8                         | 1.2                              |
| 10                        | 1.5                              |
| 12                        | 1.8                              |
| 15                        | 2.1                              |
| 18                        | 2.4                              |
| 21                        | 3.0                              |
| 24                        | 3.6                              |
| 27                        | 4.2                              |
| 30                        | 4.8                              |
| 33                        | 5.4                              |
| 36                        | 6.0                              |

- b) Record drop in pressure during test period; when air pressure has dropped more than 1.0 psig during test period, piping has failed; when 1.0 psig air pressure drop has not occurred during test period, discontinue test and piping is accepted.
    - c) When piping fails, determine source of air leakage, make corrections and retest; test section in incremental stages until leaks are isolated; after leaks are repaired, retest entire section between manholes.
  2. Test pipe larger than 36 inches diameter with exfiltration test not exceeding 100 gallons for each inch of pipe diameter for each mile per day for each section under test. Perform test with minimum positive head of 2 feet.
  3. Infiltration Test:
    - a. Use only when gravity piping is submerged in ground water minimum of 4 feet above crown of pipe for entire length being tested.
    - b. Maximum Allowable Infiltration: 100 gallons per inch of pipe diameter for each mile per day for section under test, include allowances for leakage from manholes. Perform test with minimum positive head of 2 feet.
- D. Pressure test system in accordance with AWWA C600 and the following:
  1. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping based on elevation of lowest point in piping corrected to elevation of test gauge.
  2. Conduct hydrostatic test for at least two-hour duration.
  3. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
  4. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
  5. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
  6. Compute maximum allowable leakage by the following formula:

|                                            |
|--------------------------------------------|
| $L = (SD\sqrt{P})/C$                       |
| L = testing allowance, in gallons per hour |

|                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------|
| S = length of pipe tested, in feet                                                                                                         |
| D = nominal diameter of pipe, in inches                                                                                                    |
| P = average test pressure during hydrostatic test, in psig                                                                                 |
| C = 148,000                                                                                                                                |
| When pipe under test contains sections of various diameters,<br>calculate allowable leakage from sum of computed leakage<br>for each size. |

7. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

E. Deflection Testing of Plastic Sewer Pipe:

1. Perform vertical ring deflection testing on PVC sewer piping, after backfilling has been in place for at least 30 days.
2. Allowable maximum deflection for installed sewer pipe limited to 5 percent of original vertical internal diameter.
3. Perform deflection testing using properly sized rigid ball or 'Go, No-Go' mandrel.
4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe as determined by ASTM standard to which pipe is manufactured. Measure pipe in compliance with ASTM D2122.
5. Perform test without mechanical pulling devices.
6. Locate, excavate, replace and retest pipe exceeding allowable deflection.

### 3.14 PROTECTION OF FINISHED WORK

- A. Protect pipe and embedment from damage or displacement until backfilling operation is in progress.

END OF SECTION

## SECTION 33 41 13 - PUBLIC STORM UTILITY DRAINAGE PIPING AND CULVERTS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Storm drainage piping.
  - 2. Pipe Culverts.
  - 3. Concrete Box Culverts.
  - 4. Drainage structures.
  - 5. Bedding, embedment, and backfill materials.
  - 6. Concrete encasement and cradles.

#### 1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Reinforced Concrete Pipe:
  - 1. Basis of Measurement: Pipe will be measured by the linear foot along the centerline of the pipe for the various sizes of pipe, complete and in place, in accordance with these specifications, including excavation and backfill.

Where wyes, branches or connections to existing pipe lines are involved, measurement of the new connecting pipe will be made from the intersection of its central axis with the outside surfaces of the pipe or structure into which it connects. Where inlets, headwalls, catch basins, manholes, junction boxes or other structures are included in lines of pipe, that length of pipe tying into the structure wall will be included for measurement but no other portion of the structure length or width will be so included.

For multiple pipes, the measured length will be the sum of the lengths of the barrels measured as prescribed above.

- 2. Basis of Payment: Reinforced Concrete Pipe (RCP) shall be paid for at the unit contract price bid per linear foot for the size of pipe specified at the depth specified, complete in place. The bid price per linear foot shall include all clearing, excavation, bedding material, fittings, plugs, lugs, connection to the existing system, disposal of surplus materials, laying of pipe, embedment, backfilling and cleanup. Pipe, including excavation and backfill, shall be paid for any and all depths. Unless specified otherwise, payment will also represent compensation for removal and replacement of pavement, curb, drainage structures, driveways and any other improvements damaged during construction.

- B. Precast Concrete Box Culvert:
  - 1. Basis of Measurement: Concrete box culverts of each size and type shall be measured by the linear foot. The measurement will be made between the ends of the box along the central axis. For concrete boxes used in multiple barrel structures, the measured length will be the sum of the lengths of all barrels measured as described above.
  - 2. Basis of Payment: The unit price bid, per linear foot for the various sizes and types of "Precast Concrete Box Culverts" shall be full compensation for constructing, furnishing and transporting boxes; excavation; the preparation and shaping of bed; jointing of boxes;

backfill; for connections to existing structures; concrete, reinforcing steel and all other items of material, labor, equipment, tools and incidentals necessary to complete the work in accordance with the plans and specifications. When precast boxes are laid on a skew, full compensation for cutting the ends when required by the plans, shall be included in the unit bid price per linear foot, measured in accordance with "Measurement" above. Payment will be made under the following:

a. Precast Concrete Box Culvert, \_\_\_\_ - Foot by \_\_\_\_ - Foot – Per Linear Foot.

C. Box Culvert (Cast-In-Place):

1. Basis of Measurement: Per Linear Foot.

2. Basis of Payment: Includes excavation, bedding, forms, reinforcing, concrete, joints, accessories, placing, finishing, curing, testing, and backfilling.

a. \_\_\_\_ - Foot by \_\_\_\_ - Foot Box Culvert – Per Linear Foot, Measured.

1.3 SUBMITTALS

A. Submittal procedures as specified in Section 01 33 00 – Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents:

1. Accurately record actual locations of pipe runs, connections, manholes, inlets, catch basins, and invert elevations.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Block individual and stockpiled pipe lengths to prevent moving.

B. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

C. Do not place pipe flat on ground. Cradle to prevent point stress.

D. Store UV sensitive materials out of direct sunlight.

1.7 COORDINATION

A. Coordinate the Work with termination of storm sewer, trenching, connection to public storm sewer or public drainage way.

- B. Coordinate unrecorded or variations in site conditions, and corresponding adjustments to construction requirements.

## PART 2 PRODUCTS

### 2.1 STORM DRAINAGE PIPING AND CULVERTS

- A. Reinforced Concrete Pipe (Circular): ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, Class III (or as indicated on Drawings) with Wall Type B or C (minimum); steel reinforcement; tongue and groove ends.
  - 1. Manufacturers:
    - a. J and G Concrete Products.
    - b. Forterra.
    - c. Oldcastle Precast, Inc.
  - 2. Joints:
    - a. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets, rubber compression gasket joint.
    - b. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants, preformed flexible joint sealant.
- B. Precast Concrete Box Sections: ASTM C1433 - Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers, Class, A-III or A-IV, with width and height as indicated on Drawings.
  - 1. Manufacturers:
    - a. J and G Concrete Products.
    - b. Foreterra.
    - c. Oldcastle Precast, Inc.
  - 2. Joints:
    - a. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets, rubber compression gasket joint.
    - b. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants, preformed flexible joint sealant.

### 2.2 DRAINAGE STRUCTURES

- A. Drainage Structures: Precast concrete or Cast-In-Place concrete, junction boxes, and inlets, as specified in Section 33 05 16 – Utility Structures.
  - 1. Structures shall have cast iron covers inscribed with “STORM SEWER”.

### 2.3 BEDDING, EMBEDMENT, AND BACKFILL MATERIALS

- A. Bedding Material: As specified in Section 31 23 17 - Trenching.
- B. Embedment Material: As specified in Section 31 23 17 - Trenching.
- C. Backfill Material: As specified in Section 31 23 17 - Trenching.

## 2.4 CONCRETE ENCASEMENT AND CRADLES

- A. Concrete as specified in Section 32 30 00 – Cast-In-Place Concrete for Civil Site Improvements.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify trench cut and bedding material is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings. Notify Engineer of discrepancies.

### 3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with coarse aggregate (compacted).
- B. Remove large stones and other hard or organic matter capable of damaging piping or impeding consistent backfilling or compacting.

### 3.3 EXCAVATION AND BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 - Trenching. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Dewater excavations to maintain dry conditions to preserve final grades at bottom of excavation.
- C. Provide sheeting and shoring in accordance with Section 31 23 17 - Trenching.
- D. Place bedding material at trench bottom to a compacted depth as indicated on Drawings and in accordance with Section 31 23 17 - Trenching. Level materials in continuous layers not exceeding 8 inches compacted depth. Bedding material shall be the same material as the embedment.
- E. Install pipe on compacted subgrade meeting bedding requirements. Cradle bottom 20 percent of diameter to avoid point load.
- F. Compact according to requirements.
- G. Place geotextile fabric over backfill when indicated in Drawings.

### 3.4 INSTALLATION - PIPE

- A. RCP: Install pipe, fitting, and accessories in accordance with manufacturer's recommendations.
- B. Place pipe on minimum 6 inch deep bedding, or as indicated in Drawings.
- C. Lay pipe to slope gradients noted on Drawings. Connect pipe to drainage structures.
- D. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

- E. Install embedment at sides and over top of pipe and compact in accordance with Section 31 23 17 - Trenching and as indicated on Drawings.
- F. Refer to Section 31 23 17 – Trenching for backfilling and compacting requirements. Do not displace or damage pipe when compacting.

### 3.5 INSTALLATION – PRECAST CONCRETE BOX CULVERT

- A. Excavation, bedding, embedment, and backfill shall conform to Section 31 23 17 – Trenching.
- B. Lay box culvert sections to the slopes and grades indicated on the Drawings.
- C. Jointing materials shall be provided and installed as specified herein.
- D. Connections of precast boxes to headwalls, wingwalls, junction boxes, riprap, or other structures shall conform to the Drawings.

### 3.6 INSTALLATION - DRAINAGE STRUCTURES

- A. Install catch basins, inlets, junction boxes, manholes, headwalls, and end treatments in accordance with Section 33 05 16 – Utility Structures.

### 3.7 FIELD QUALITY CONTROL

- A. Section 01 40 00 – Quality Requirements.
- B. Request inspection prior to and immediately after placing aggregate cover over pipe.
- C. When tests indicate work does not meet specified requirements, remove work, replace and retest.

### 3.8 PROTECTION OF FINISHED WORK

- A. Protect pipe and aggregate embedment from damage or displacement until backfilling operation is complete.
  - 1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
  - 2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION